



First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

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## Flight

*The Aircraft Engineer and Airships*

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## DIARY OF FORTHCOMING EVENTS.

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:

- Oct. 21 ... Lectures, "A Comparison of the Flying Qualities of Single and Twin-Engined Aeroplanes," by Squadron-Leader R. M. Hill, and "Night Flying," by Mr. Cecil Baker, at the Royal Society of Arts, John Street, Adelphi
- Oct. 23 ... Gordon-Bennett Balloon Race, Indianapolis, U.S.A.
- Oct. or Nov. U.S. National Aeroplane Race (New York to San Francisco)
- Nov. 1 ... First Open Competition for R.A.F. Boy Mechanics
- Nov. 4 ... Lecture, "The Human Machine in Relation to Flying," by Wing-Commander Flack, at the Royal Society of Arts

## EDITORIAL COMMENT



HERE cannot be the least doubt about the German intention to make a determined bid for the supremacy of the commercial air routes, with its almost inevitable military preponderance of air power. Some weeks ago we discussed the German plans for a trans-oceanic airship service, and pointed out that the difference between the Hun method and our own was that the former has been quietly preparing for the lifting of the embargo on construction, while we have been wasting time in fruitless bargaining between the Government and those who were prepared, on reasonable terms, to take over and run the rigid airships which were constructed as a part of our war effort. The net result of this difference in method will be that the German overseas service will, unless the circumstantial reports which come from Germany and America are completely unfounded, be an accomplished fact early in the New Year, while our own will still be "under consideration."

It is fortunate that there is some prospect that the Air Conference, which is now in being, will give an opportunity for clearing up the whole situation so far as the big rigid airships are concerned. We say advisedly that it will give the opportunity, because we are not particularly sanguine about any real information being forthcoming regarding the negotiations which have been in progress between the Government on the one hand and certain shipping and armament interests on the other, relative to the sale to the latter of these craft. We have understood all along—though it must be said that the utmost secrecy has been maintained as to details, that the interests mentioned were really keen to take over the ships and to run them commercially. On the other side, it has been equally well understood that the Government were anxious to get rid of them as being an expensive incubus in peace time. Why, then, if both parties were as willing as they are said to have been, have the negotiations failed to fructify in a bargain? Or have they absolutely broken down altogether? It is to be hoped that something will

transpire to clear up the matter. At least we may be enlightened as to the Government terms, which we believe have been such as could not possibly be accepted by the other side. We are not so much interested in the commercial bargaining side of the matter as we are in the reasons for the breakdown in the *pourparlers*, which is leading us into the position in which we, with several very serviceable airships actually in hand, are to be left behind by Germany who has none. It all seems to be very deplorable.

Not only in airships is Germany determined to make up the leeway she has made as a result of her defeat in the War. It is understood that she has consummated a big combination of interests between the North German Lloyd Co. and leading aviation companies in Austria and Denmark. The combine plans to work services with Switzerland, Austria, Turkey and Italy, and also to establish linking services with the international air lines of Western Europe. We see no reason why Germany should not go ahead in the air. The main thing is that while our late enemy, crippled and impoverished by defeat in the world War, is making extensive plans which will presently blossom forth as completed schemes, we are still busy with the discussion of whether or not we are to maintain an aviation industry—for that is what the position amounts to here.

**Popularising Flying** For quite a long while, ever since the end of the War, in fact, *FLIGHT* has laid continual emphasis on the fact that the only way to make commercial aviation a complete success is by educating the general public in its safety, its certainty as a mode of transport, and, above all, its vast possibilities for linking up the countries and peoples of the earth. Not a single person who has interests in aviation but agrees with the point of view, yet so little imagination have we as a race that it has been left for our Allies across the Channel to give actual expression to this popular truth. The Aero Club of France in conjunction with the Ligue Aéronautique, is making an appeal through the President, M. Michelin, for funds to create an appreciation among the general public of the vital importance of aerial navigation in its bearing upon national security. Already a very substantial sum of money has been raised as a result of the appeal.

We have urged on many occasions that there is only one possible way in which the suffrages of the man in the street are to be gained for the cause of aviation and that is by making him practically familiar with all its possibilities. Even though the War made him accustomed to seeing aeroplanes in flight and the reading of their performance may have given him to think that there was rather more in flying than he had been led to believe, aviation is still something with which he has not actually come face to face and he retains to some extent the belief that those who fly in aeroplanes are of the stuff of which heroes are made and that aerial travel is not for the ordinary person. He will never believe differently until flying has been brought, so to say, to his door and he has been enabled to test for himself the ease and safety of it.

In a letter to *The Times* Mr. Holt Thomas urges that such educative work should be undertaken here, ensuring that next summer as many members of the public as possible should be given their "baptism of the air." Such propaganda work, he says, would

be of immense benefit to both civil and Service aviation and to the whole progress of aeronautics. This work should be undertaken on a co-operative basis and without regard to profit. All the bodies and associations connected with flying, and the authorities themselves, should begin to lay plans now for a great organised scheme of air passenger carrying next year. The country, he says, should be mapped out; a regular itinerary should be planned for large passenger craft, not only heavier-than-air but lighter-than-air. Local municipalities and the Press should be encouraged to help, and the fees for short flights, which might be devoted to the cost of organisation and operation, should be so low that flying would be literally within the reach of all.

The idea is altogether admirable and it might well have formed an item for the Air Conference in all its bearings, with a view to the immediate organisation of a scheme which commends itself to us as the most useful possible kind of propaganda. As we have so often urged upon our readers, what is essential more than anything is propaganda of the right kind—and this is most certainly the best kind we could possibly have.

**The Air Age** In an ably reasoned leading article, the *Daily Telegraph* on Saturday last dealt in advance with the work and deliberations of the Air Conference which has been sitting at the Guildhall during the present week. We need not follow the *Telegraph* through the whole of its summary of the proceedings of the Conference, but we are particularly struck by the concluding sentences of the article in question. In expressing the hope that Mr. Churchill would use the occasion for outlining a national policy in regard to aviation, the *Telegraph* says:—

"He cannot be unconscious of this country's increasing weakness in air power, whether considered from the defensive commercial, or political standpoint. During the later stages of the War we asserted a command which contributed to our victory, and if we are to reap, in full measure, the fruits of that historic success we must take every step, compatible with the existing financial position, to support this infant industry and develop inland and oversea air services. At the same time the creation of adequate reserves of strength, which we can exert swiftly in case of emergency, is essential. We are at the dawn of the air age, and we must, as a matter of security as well as profit, maintain the lead we gained during the War, and thus place civil aviation on a profit-earning basis."

Here is the whole case in a very few words. It is so admirably put that we really feel there is nothing that can usefully be added to it. Indeed, it would be impossible to add anything, save by way of elaborating the arguments, and as we have reiterated them time after time during the past two years or nearly, the task would be one of supererogation in any case.

**The Development of Air Mails** In the course of a recent lecture, given by Sir Frederick Sykes, the Controller-General of Civil Aviation, before the members of the Royal Aeronautical Society, the lecturer succeeded in conveying the impression that it was mainly to the carriage of mails that the aeroplane service of the immediate future must look for its success. The question, he said, should not be approached by considering what mails could, but what mails could not be carried by aeroplane. To make his point he said that the area of the British Isles was not very favourable for the carriage of mails by an

extensive aerial service which could only be operated by day. On the air service to the Continent, on the other hand, a great saving in time was effected and he would like to see a very material increase in the amount of mails thus carried, with the ultimate result that all the Continental mails should be carried by the certified air services at normal rates.

With this latter view we entirely concur. Indeed, it is what we have been urging for some considerable time past, because we are convinced that aerial transport has definitely established itself as a safe and speedy means of communication and has completely proved itself during more than a year of practically uninterrupted service between England and the Continent.

Both the Postmaster-General, who presided, and Mr. Handley Page rather disagreed with General Sykes on the mail question. The latter pointed out that although 7,000 letters were carried by air in the month of August it meant only about 40 lbs. per day, and from the point of view of the transport companies that was not a very remunerative undertaking. On the other hand, every passenger represented about 180 lbs. while a letter only weighed from half an ounce to an ounce. The question was largely one of the balance-sheet. The Postmaster-General also queried the point of view that the future of civil aviation would depend upon the carriage of mails. He thought, he said, that they would only form a very auxiliary sort of cargo for both aeroplanes and airships, which would depend mainly upon the carriage of goods and passengers.

We entirely agree with these views. It would be

utterly impossible to carry on anything like an extensive aerial service by the carriage of mails alone, even if all the mails despatched between one point and another were carried by air. Undoubtedly, civil aviation will depend principally on passengers and goods for success, and, as Mr. Illingworth said, mails will be an auxiliary—a valuable one, it may be, but still an auxiliary. A great deal of stress has been laid lately upon the carriage of mails by air, and with good reason, so it is possible that the impression has become accepted that it is to mail carrying that civil aviation and those concerned in its development look for their main support. That is not so at all. The reason why we, among others, have emphasised the subject of aerial mails is because it is by awarding contracts to the firms engaged in developing air services that these services can best be assisted by the State without pauperising the industry. In its present state of development such contracts mean to civil aviation all the difference between almost certain failure and keeping its head above water until the speed, safety and convenience of aerial services are brought home to the travelling and commercial public who can alone make the movement a permanent success. Obviously, if services are to be mainly operated for the conveyance of mails, their scope and development must be very limited in comparison with other methods of transport. As a matter of fact, if the movement was to be confined within such narrow limits we should be inclined to say that there was so little in it as to be scarcely worth while wasting time, money and energy in its development.



## AIR MINISTRY COMPETITION, 1920

### Amphibians Awards

The Air Ministry announces:—

The Judges Committee consider that the results achieved in the competition for amphibians show that a considerable advance has been attained. The conditions to be fulfilled were such as had received little attention in the past, and the competing firms deserve congratulation upon the enterprise they have shown.

The committee are of opinion that the proportion of the monetary awards, laid down for this competition, does not adequately represent the relative standards of merit of the first two machines, and

they recommend an increase in the amount of the second prize.

The following sums have, therefore, been awarded—

**First Prize: £10,000**

Messrs. Vickers, Ltd., Vickers "Viking III," fitted with 450 h.p. Napier "Lion" engine.

**Second Prize: £8,000**

Messrs. Supermarine Aviation Works, Ltd., Supermarine Amphibian, fitted with 350 h.p. Rolls-Royce "Eagle VIII" engine.

**Third Prize: £2,000**

Messrs. Fairey, Ltd., Fairey Amphibian, fitted with 450 h.p. Napier "Lion" engine.



## ROYAL AIR FORCE MEMORIAL FUND

A MEETING of the Executive Committee was held at 7, Iddesleigh House, Caxton Street, S.W. 1, on September 30, 1920, Lord Hugh Cecil occupying the chair.

Grants in aid of necessitous cases, amounting in all to £607 15s. were passed and payment authorised. This includes a sum of £420 10s. paid on behalf of this Fund by the Flying Services Fund of the Royal Aero Club.

The Royal Air Force Aerial Pageant held at Hendon on July 3 produced the very handsome nett balance of £6,729 6s. 4d., the whole of which has been paid into the credit of the Fund.

Similarly the Royal Air Force Ball held at the Ritz Hotel on July 8 produced £555 8s. 9d.

Proposals regarding the Royal Air Force Concrete Memorial were held over for discussion at the next Meeting.

A scheme for visiting large industrial centres throughout the Kingdom with a view to appealing for funds, was discussed and referred to a sub-committee.

Numerous letters from the Viceroy of India and Governors of Colonies and Dependencies (in answer to a letter asking for help from the Chairman) were read to the Meeting.

	£ s. d.
Amount of subscriptions announced up to July 20	90,166 18 5
Amount received since above date to September 30, 1920	5,839 2 0
Total to date	<hr/> 96,006 0 5

# THE AIR CONFERENCE, 1920



Between sessions, in front of the Guildhall, on the Opening Day.

At the Air Conference, held in the Council Chamber of the City of London at the Guildhall (by kind permission of the Lord Mayor) on October, 12, 13 and 14, a series of very valuable papers were read, and were followed later by interesting discussions. It has been impossible, from considerations of space, to publish the papers in full in this week's issue of *FLIGHT*, but in the succeeding pages we give the following brief synopses which will indicate the character of the papers, and we hope to be able to publish the papers in full as far as possible in proper sequence.

The Conference brought together a very large and representative gathering of those associated with aviation, whilst among the countries officially represented were France, U.S.A., Japan, Sweden, Holland, Argentine, Germany, Portugal, Switzerland, Paraguay, Italy, Belgium, Spain, Rumania, Brazil, Poland, and Norway.

The Lord Mayor opened the proceedings and then vacated the chair in favour of Lord Montagu of Beaulieu, who presided on the first day, General Sir Frederick Sykes and Mr. White-Smith reading their respective papers in the morning and evening, and at the conclusion of the afternoon session the following resolution was proposed by Mr. Holt Thomas, seconded by General Brancker, and unanimously carried:—

"That this Conference calls on the Government to decide definitely that all first-class mail matter shall be sent by air mail on selected mail routes of importance."

The chairman undertook to forward a copy of the resolution to Mr. Churchill.

At the inaugural lunch, when Mr. Winston Churchill, the Secretary of State for War, presided, the following guests were present:—Mr. W. F. Nicholson, C.B., Mr. H. White-Smith, C.B.E., Lieut.-Col. F. K. McClean, Sir James Stevenson, Bart., Mr. P. W. Rylands, Maj.-Gen. Sir F. H. Sykes, G.B.E., K.C.B., C.M.G., Sir Alan Anderson, K.B.E., Sir Arthur Duckham, K.C.B., The Lord Riddell, Rt. Hon. Lord Montagu of Beaulieu, K.C.I.E., C.S.I., Field-Marshal Sir H. H. Wilson, Bt., K.C.B., Air-Marshal Sir Hugh M. Trenchard, Bt., K.C.B., Sir John Cadman, K.C.M.G., Air Vice-Marshal Sir E. L. Ellington, K.C.B., Sir Charles Wakefield, Bt., Air-Com. H. R. Brooke-Popham, C.B., C.M.G., D.S.O., Sir Robert A. Hadfield, Bt., Rear-Admiral Sir C. F. Lambert, K.C.B., Rear-Admiral Sir E. F. Inglefield, K.B.E., Mr. F. Handley Page, C.B.E.

Col. H. B. T. Childs, Sir R. T. Glazebrook, K.C.B., Capt. G. de Havilland, Professor Chalmers Mitchell, Lieut.-Com. H. Warden Chilcott, M.P., Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P., Mr. Griffith Brewer, Mr. H. Massac-Buist, Major G. H. Scott, C.B.E., A.F.C., Mr. S. Instone, Mr. W. E. Berry, Mr. J. A. Spender, Wing-Com. A. H. W. E. Wynn, O.B.E., Major W. T. Blake, Major C. C. Turner, Mr. W. L. Mallabar.

Sir James Allen, Col. F. Searle, Maj.-Gen. E. D. Swinton, C.B., D.S.O., Mr. J. L. Garvin, Mr. J. D. Walker, M.B.E., Mr. G. B. Cockburn, Professor L. Bairstow, C.B.E., Capt. Murray F. Sueter, C.B., R.N., Commandant J. Sable, Group-Capt. A. J. L. Scott, C.B., Lieut.-Col. Sir H. A. Van Ryneweld,

K.B.E., D.S.O., M.C., Mr. Harry Harper, Mr. R. W. Blankenberg.

Air Vice-Marshal J. F. A. Higgins, C.B., D.S.C., A.F.C., Air Vice-Marshal Sir J. M. Salmond, K.C.B., C.M.G., Maj.-Gen. Sir W. Sefton Brancker, K.C.B., A.F.C., Mr. C. G. Grey, Flight-Lieut. G. W. Dobson, O.B.E., Lieut. C. P. Robertson, Mr. Stanley Spooner, Sir Evelyn Murray, Sir Napier Shaw, Maj.-Gen. Sir R. M. Ruck, C.B., Capt. F. C. Broome, Capt. F. S. Barnwell, Air Vice-Marshal A. V. Vyvyan, C.B., D.S.O., Mr. A. V. Roe, Capt. S. Cockerell, A.F.C., Col. A. Ogilvie, Mr. G. Holt Thomas, Mr. Phillips Air-Com. E. M. Maitland, C.M.G., D.S.O., Mr. S. A. Boulton.

Mr. Churchill, at the conclusion of the lunch, said that he thought it was a really good thing to have an Air Parliament, and he thought that the present very pleasant inauguration of the first of its character was remarkable, and he hoped it was not to be the last. We ought to have a fixed meeting place once a year, when all those who were interested in the great art of aviation, those who had put their lives into it, their money and their knowledge, could gather together and discuss, organise and mobilise the interests of the air, in order that they might receive proper recognition and support. He thought a great deal of gratitude was due to the press for the help which had been given to aviation, which at this particular period was of great value to the cause of British aviation. The discussions on civil aviation which were now taking place should, he thought, not end simply in discussions, having regard to the character of the Air Conference gathering. They should culminate, he thought, in a strong resolution, although of course this would hardly bind the Government. If we were ever to take into consideration the possibility of any aggressive action on any nation's part in spite of wise statesmanship, then aviation for military purposes was a vital item in the defence of this island.

We should cease to enjoy the unique superiority which our insular position had given us through all the centuries if we lost control of the arts which led to aerial superiority. Our Navy, however great and efficient, would be no substitute for an aviation which had been hopelessly neglected.

It was impossible to consider the defence of these islands and the security of the people of these islands—it was impossible to organise any system of secure defence, even the most modest—except on the basis of a real and effective and supreme local control of the air. The foundation through long years of peace of any military expansion must be an active civil development. All the future of military

aviation would be dependent on the widespread development of civil aviation

The Government intended to assist aviation by every means in its power. Our resources, however, were limited, but he trusted the day had now come when it would be possible for the Government to increase to some extent the resources which were available for the development of civil aviation. In the main civil aviation must fly by itself, and the function of the Government would be to facilitate, stimulate and encourage its action. He did not think three years should be too much to reconstruct the air service, so that our fathers of every grade of national life would be glad to send their sons into it with the feeling that they were giving them a good start in life with the possibility of a fine career. More than half the great air forces which had been raised had been engaged in the operations now going on in the Far East, and this interfered with the development of civil aviation. The Air Estimates for this year would shortly have to be considered and he excluded any

solution which would be likely to help us through those two or three difficult years which lie in front of us. To suppose that the world, having got into the air, was ever going to get out of the air, was as absurd as to suppose that the world, having taken to steamships, was going back to schooners and sailing ships. They were there to drive away pessimism, and to assert their view and contention that a great and bright future was opening for British aviation. He hoped in future years the Air Parliament would not be upon a selected basis, but rather upon a nominated representative basis, a body which would carry with it the authority of the whole air world. In conclusion he wished success to the Air Parliament.

Lord Montagu, in proposing the toast of Mr. Churchill, said that an Air Parliament should be of immense help in influencing both the Government and Parliament. Much as we all appreciated what the Secretary of State for War had done for aviation, most of us still looked towards the time when we should have a separate Air Ministry.

## SYNOPSIS OF THE PAPERS READ

### "CIVIL AVIATION AND AIR SERVICES"

By MAJOR-GENERAL SIR FREDERICK H. SYKES, G.B.E., K.C.B., C.M.G., Controller-General of Civil Aviation

#### INTRODUCTION

##### I. The Growth and Present Position of Air Mail, Goods, and Passenger Services

(a) United Kingdom—Internal. (b) United Kingdom—Continent.—London-Paris service. London-Brussels. London-Amsterdam.

Statistical tables illustrating the development of British Civil Aviation.

Amount and type of general traffic. Number of arrivals and departures at and from the United Kingdom. Number of letters carried. Customs returns. Accidents.

(c) Foreign.—French, Belgian, Dutch, German, Norwegian, Danish, and United States air services, with special reference to:—

(i) The projected service from Paris to Prague, Warsaw and the Balkan capitals. (ii) The North European Service—Copenhagen, Hamburg, Bremen, London. (iii) The United States Post Office air mail system.

(d) British Dominions and Colonies.—No services yet existing, but future success depends on sound preliminary work. Composition and work of the Canadian, Indian and New Zealand Air Boards. Aviation in Bermuda and the West Indian Islands. The position with regard to the Imperial air routes.

#### II. Factors Contributing to Successful Air Services

(a) Improvements in design and construction so as to secure safety, reliability, regularity, speed and comfort. Results of the Air Ministry competitions. Safety devices and testing. All metal machines. Effect of climate. Speed versus weight-carrying capacity. The human element. (b) Use of different types of aircraft. Combination on relay system of aeroplanes, seaplanes, amphibians and airships. (c) General organisation of aerodromes and seaplane stations. Organisation for night flying. Progress in the use of wireless especially for navigation, direction finding, and wireless telephony. Flying in mist and fog. (d) Meteorology. Methods of issuing information. Value of upper air observation. Economic aspect of meteorology. (e) Economic and financial factors. Subsidies. French and British schemes compared. Insurance: the French "Consortium" and the Scandinavian "Pool." (f) Carriage of mails. Considerations of speed. Night flying. Co-ordination of air and ordinary mails. The United States air mail service considered.

#### III. Suggestions for Future Development of Air Services

Influence of geographical conditions. Future development of European and American trunk lines. The Imperial problem. Air communication between British possessions.

### "THE OPERATION OF CIVIL AIRCRAFT IN RELATION TO THE CONSTRUCTOR"

By MR. H. WHITE-SMITH, C.B.E., Chairman of the Society of British Aircraft Constructors

#### INTRODUCTORY

##### I. The Present Lack of Financial Success in Operating Air Services and its Main Causes

##### II. The Air Travel Habit and Safety

##### III. Reliability of Air Services

##### IV. Costs of Operating Commercial Aeroplane Services

##### V. Future Demands of the Transport Operators on the Aircraft Constructor

#### VI. Present Position of Seaplanes, Flying Boats and Amphibians. Commercial Services

#### VII. Aircraft Engines

#### VIII. Aircraft and Engine Maintenance and Repairs in Service

#### IX. Special Requirements and Opportunities for Aircraft in Foreign Countries

#### X. Conclusion

[This paper is reproduced practically in full on pages 1079-1088.—ED.]

### "THE PRESENT POSITION OF AIRCRAFT RESEARCH AND CONTEMPLATED DEVELOPMENTS"

By AIR VICE-MARSHAL SIR E. L. ELLINGTON, K.C.B., C.M.G., C.B.E., Director-General of Supply and Research

During the War the impetus was entirely military, the all-important factor in research being speed of progress in the development of fighting machines. There was no time to devote to lines of research which did not promise practical results almost immediately in view of the prospective end of the War, with the result that aircraft and engines produced during the War were almost entirely developments of pre-War types. The progress made in armament, navigational instruments and other accessories, with little or no pre-War experience available, was more fundamental. Generally speaking, development might be described as conventional rather than radical. Such an opportunist policy as the War demanded is, however, quite unsuitable for times of peace. It is no longer a sound policy to sacrifice everything to immediate results and accept the risks involved in decisions based upon insufficient technical data; the principles of scientific research must once more be rigidly applied, and progress only sought along a line of

#### PRESENT POSITION AND CONTEMPLATED DEVELOPMENTS

The main developments now in progress or under contemplation for military and civil aircraft are dealt with under the following heads:—

(a) Aeroplanes and seaplanes, and engines. (b) Airships and kite balloons. (c) Navigational instruments and apparatus. (d) Accessory developments to increase the comfort, safety, and efficiency of the passengers and crew.

#### (a) Aeroplanes and Seaplanes, and Engines

The main requirements for aeroplanes and seaplanes are stated to be, broadly:—

(i) Reliability. (ii) Controllability. (iii) Capacity to take off or land in a restricted area. (iv) Performance. (v) Safety and comfort. (vi) Cheapness.

These points are dealt with in detail, and their relative importance for civil and military machines discussed.

(i) *Reliability*.—Reliability is largely a question of engine, and more particularly engine accessories, such as magnetos, and petrol, oil and water cooling systems. The new types of engines now being considered are dealt with under this heading, which apart from normal developments of existing types include the steam turbine, the Swash plate engine, and the possible application of the Diesel principle to aircraft engines.

(ii) *Controllability*.—This question is reviewed with particular attention to the control of big engined machines, and the problems affecting those with a central engine room.

(iii) *Capacity to take off or land in a restricted area*.—This is of the greatest importance in both civil and military machines. The problem is mainly one of wing and propeller design, and particularly the development of a satisfactory variable camber wing. Reference is also made to the question of landing aircraft on ships.

(iv) *Performance*.—In military machines, the need for performance is paramount, and while it is also important for civil machines, considerations of reliability, comfort, etc., must receive greater weight. The development of engines from the point of view of lightness is discussed.

(v) *Safety and Comfort*.—The steps which are being taken to promote safety and comfort of passengers and crew are dealt with later in the paper.

(vi) *Cheapness*.—The importance of cheapness in construction and maintenance is self-evident for civil aircraft, and it is also of the greatest importance for War purposes in that cost is a reflection of time and labour expended. Efforts are being made to produce more durable machines by introducing a wider use of metal construction. Metal propellers are also being developed, and cheaper forms of fuel are being investigated.

#### (b) *Airships and Kite Balloons*

(i) *Airships*.—The construction of rigid airships in this country is entirely a War development. The first ships built followed closely the established German practice, but there are now under construction two ships embodying new principles of hull construction which have been developed in this country—the "R.80" and "R.38."

An insight into the most recent German practice has been afforded by the surrender of the "L.71" and "L.65," the most noticeable features of which are the construction of the gas bags, and the arrangement and reliability of the machinery. In both these directions special research is being undertaken.

Considerable success has attended the efforts made to develop a method of anchoring airships in the open by means of mooring masts, thereby obviating the necessity of sheds except for extensive repairs.

The possibility of carrying aeroplanes on airships is also being investigated. Research is being carried out on a variable pitch propeller for airships, and also on methods of recovering the water from the exhaust gases of the engine, which, if lost, means a reduction of weight of ballast, thus necessitating a discharge of gas.

### "TECHNICAL ASPECTS OF SERVICE AND CIVIL AVIATION"

By CAPTAIN F. S. BARNWELL, F.R.Ae.S.

#### *Over-all Design*

To consider firstly the best disposition of the various members of an aeroplane.

By the end of the War the single-engine tractor biplane had practically a monopoly, except for machines too large for a single engine (of the highest power made). For these one other type fairly established itself, the twin-engined tractor fuselage biplane.

Of these same two types are practically all aeroplanes used for civil flying up to date.

There are many reasons for the predominance of these two types.

#### (REASONS DETAILED AND COMMENTED ON)

Now that we have more time for careful investigation, before designing new machines, the first point to be considered is: Are there possibilities of obtaining better all-round machines by radical alteration of over-all design? It seems distinctly doubtful; and we cannot, for the present, hope to attain any great advantages by doing so, unless there are radical alterations in power plant. It appears reasonable to continue with the development of the single-engine tractor type for all machines up to the largest that will be satisfactory with the largest satisfactory engine. It is improbable, however, that the biplane is right for all sizes and purposes. For any type of wing structure it seems probable that, up to a certain limit of weight, a monoplane form is best; beyond this, and up to some other limit, a

(ii) *Kite balloons*.—Though it is not anticipated that kite balloons will be used again for observation as they were in the recent War, captive balloons have a value for meteorological and other special purposes which are being investigated.

#### (c) *Navigational Instruments and Apparatus*

The development of compasses, turn indicators, and other instruments, is discussed, including directional wireless and navigation by astronomical observations.

The principal difficulty in navigation at the present time is landing in fog, and the hope is expressed that a solution may be found to the problem of fog dispersal. In the meantime, efforts are being made to mitigate the difficulty by means of landing flares and electric lighting devices similar to those now employed for landing by night. As fogs are normally confined to a few hundred feet from the ground, devices for landing a machine automatically from a known height are being explored. Two methods for finding the true height of an aeroplane from the ground (or sea in the case of seaplanes) are being investigated; one by means of sound, and the other by the use of wireless telegraphy.

#### (d) *Comfort, Safety and Efficiency of Passengers and Crew*

The most important lines of development under this head are those directed to the prevention of fire and the use of parachutes.

In order to minimise the risk of fire, the separation of the passengers and crew from the engine and petrol tanks by means of bulkheads is being considered, as also are devices for releasing petrol tanks in case of fire. For military machines, improvements in self-sealing tanks to withstand incendiary bullets, and also tanks which offer the least chance of catching fire in a crash, are being investigated.

The provision of parachutes is a controversial question. Against the obvious advantages are to be set the fact that it is only when a machine has got out of control that the call for a parachute descent would arise, and in these circumstances the question of getting clear would be a very difficult one. In all machines, and particularly military ones, the extra weight is a consideration. There is no doubt, however, that the provision of parachutes may be the cause of some lives being saved, and for that reason they are now being fitted in all R.A.F. machines of the small types where possible. Two types of parachutes are being developed, one in which the occupant jumps from the machine, and the other in which the parachute is blown open as the machine descends, thus lifting the occupant clear.

An important source of accidents is that due to starting engines by propeller swinging. To meet this, mechanical starters are in existence, but a successful starting apparatus which forms an integral part of the machine and its engine has not yet been tried out.

From the point of view of comfort, mention is made of oxygen apparatus, electrically heated clothing, and other improvements of a less important nature.

#### "OUTLINE OF PROPOSED LINES FOR RESEARCH GIVEN"

For machines too large for any single engine (assuming that it is proved economical to build such) it is doubtful whether engines mounted along the wings give the best solution. The weight saved by mass distribution is mostly lost again in increased weight required to resist stresses due to vibration and drag forces. For large machines, particularly of the flying-boat type, it seems possible that a type with central engine room and geared twin airscrews offers the maximum desirable features. Another type worth consideration is the single tractor airscrew machine, with multiple engines geared to the single tractor.

As regards information which designers require with respect to over-all design: Many experiments on models of different types of complete aeroplanes, with airscrews running; the models to be as large as possible, and the wind speed as high as possible; the drag forces on the models to be analysed.

Considerably more research on methods of determining the forces applied to, and the load factors requisite for, all parts of the structure. It cannot be said that our present methods are entirely competent to ensure the requisite strength and the minimum weight for all parts of the structure. Research is wanted on questions of weight and efficiency of gearing, the necessary clutches, etc., and on the gain in propeller efficiency and drag reduction for the gear-driven airscrew machine, as against the wing-engine machine.

Above all is wanted demand for new aeroplanes, with all requirements fully and accurately stated and strictly adhered to.

*Turning to Detail Considerations*

**Airscrews.**—No great advance can be made in efficiency for any one set of conditions; under good conditions probably no more efficient thrust producer is possible, certainly at same weight.

Durability must be considered together with first cost; metal is not necessarily better than wood on these considerations.

Research work is required on suitable covering for wood blades, to resist abrasion of long grass, rain, etc.

Metal propellers appear desirable, but must prove their superiority in service.

More experiments might be made on the sword-blade type of multi-blade screw. For further development, the first step is the production of an airscrew whose pitch is variable simply and accurately on the ground; this is practically accomplished. The next step is the production of one whose pitch is variable in flight.

The ideal to be aimed for is an airscrew whose pitch and diameter may be varied in flight.

**Engines.**—The future of aeroplanes depends largely on engine development.

Assuming that the reciprocating type of internal combustion engine is, on the whole, the best method of converting the heat energy of fuel into rotative power, we must aim at using heavier fuel than petrol. The development of paraffin carburettors seems highly desirable.

Should it be possible to dispense with electrical ignition, even if only after starting up, this would be a great step towards reliability, especially as this would probably involve direct injection of fuel and scrapping of carburettors.

Really sound reduction gears between crankshaft and airscrew shaft are almost essential for commercial aeroplanes. All engines should be designed with these, and with provision for varying the gear ratio as simply as possible. It is also desirable that the length of nose be made greater than present practice.

Air-cooled engines must be developed. Radials, essentially light per horse-power, seem correct for service machines; but the development of "line" cylinder air-cooled engines, say, six-cylinder single row and twelve-cylinder Vee, seems highly desirable for commercial work.

Is it not possible to produce satisfactory inverted engines, vertical or Vee? The advantages, for single-engine tractor machines, would be enormous.

There seem possibilities also in the two-stroke engine for aeroplanes, provided it can be kept of the simple transfer port type.

**Wings.**—Probably the best means of comparing wing forms is by a curve of  $L/D$  on a base of lift coefficient, the base being laid out as fractions of maximum lift coefficient. From such a curve one can see at once which wing form will give the minimum drag, at any particular multiple of stalling speed.

We probably have sufficient model data on aerofoils of rectangular plan form and constant section. We require data on aerofoils of tapering section, tapering plan form, tapering plan form and section. Unfortunately, this gives such an enormous field that it will be hard to decide the best systems to work on.

There seem distinct possibilities of improvement in performance and structure in the employment of cantilever wings, of thick section at point of support, tapering in thickness towards the tip, this particularly in conjunction with metal wing spars.

Full scale experiment on wing forms is essential at present, simultaneously with wind tunnel work. Sooner or later we should be able to do practically all experimental work in the wind channel.

As regards structure of wings, there seems to be a general opinion that wings will be perfect when made entirely of metal, and only then. This may be so, but it is open to doubt, and there seems no purpose in decrying wood and fabric because they are wood and fabric; both are very excellent structural materials. Research is required into protective covering for wood, particularly with respect to preventing its "drying-out." Research is required also into protective covering for metal; it is possible that the difficulties are as great as for wood.

A decided superiority of metal over wood is cheapness and soundness of production in very large quantities; and it is mainly because I trust and believe that aeroplanes will eventually be built in very large quantities that I advocate metal construction. For the present I should advocate metal spars, ribs, edges, etc., but fabric covering. With the highest wing loadings practicable at present fabric is quite a sufficiently strong material, and it is not yet proved that its durability compares very unfavourably with that of very thin sheet metal. Metallic covering must be heavier than fabric, and unless the metallic covering constitutes as well the strength members of the wing, in fact is the wing, the weight will be prohibitive. The strength of a metallic shell of wing form is practically impossible to calculate; it must be found by experiment. Certainly it appears well worth while constructing and testing metallic shell wings, but it will be expensive work.

**Bodies.**—The question of body structure is much the same as that of wings, with the difference that fabric is a less suitable material for covering bodies than wings.

Research is wanted on the question of suitable covering material, light, stiff, durable, oil-proof, etc.

At present the soundest form of body is probably a girder built up of steel tube longitudinals, and struts and steel wire tie-rods, and covered with a suitable material.

The monocoque form of body looks very pretty (if well made, and partly because of this (I think) has many advocates. But it must be considered fairly on its merits. It, again, is a structure whose strength, and, therefore, ultimate detail design, must be determined largely by experiment. It seems highly desirable that a series of comparative tests of monocoque bodies (both of metal and of plywood), girder bodies of metal, and girder bodies of wood and steel tie-rods be carried out.

**Alighting Gear.**—This is probably the worst designed part of a normal aeroplane. It is a nuisance aerodynamically, and perhaps this may explain a certain lack of attention.

The life of an aeroplane depends largely on a good undercarriage.

It seems certain that, in future, undercarriages must be designed with long range of shock-absorber travel, with oleo dashpots, with large wheels and tyres, with efficient brakes. This last requirement calls for front wheels; these may either be designed as secondary organs (only coming into action to prevent somersault) or as definitely taking part of the load all the time. The latter appears the more logical procedure.

The brakes should be capable of independent operation for steering on the ground, thereby dispensing with the so-called steerable tail skid, which is, on the whole, unsound.

After achieving an undercarriage with really good ground work qualities comes the reduction of its drag in flight. Suitable fairing around tandem wheels and of the other members may be found sufficient for machines of medium speed; but, probably, for long range fast machines some form of folding gear will be evolved. Drawing the whole undercarriage up into the body is impracticable, as it takes up much space in the most useful part of the body. The most promising idea appears to be that of folding the undercarriage out and up against the under surface of the wing, suitable recesses in and (or) fairings on the wing being provided for its accommodation.

A considerable amount of research is wanted on undercarriages.

Wind tunnel experiments on different forms, and varied fairings of each form; tests on oleo dashpots; tests on air dashpots; the practicability of manufacturing springs of tubular steel, and tests on same; the practicability of solid-tired wheels. The instructions, as at present drawn up, for stressing undercarriages are not entirely satisfactory, and should be reconsidered.

**Fuel Systems.**—Accurate and fool-proof fuel gauges, easy to instal at a distance from the tank, suitable for either pressure or non-pressure tanks, are very badly needed. Sound metallic joints for fuel pipes must be evolved, and the use of mild steel piping suitably covered inside and outside seems well worth considering.

**Controls, Surfaces and Actuating Gear.**—A certain amount of additional research work is required on the efficiency of control surfaces, on the forces on them and caused by them, and, particularly, on the balancing of them. It is necessary also that the stresses due to the balancing surfaces be investigated simultaneously.

It seems possible that some form of electrical or hydraulic transmission between controls and control surfaces might be evolved, and be considerably easier to instal than the present direct system of cables leading over many pulleys and through many guides.

## "ASPECTS OF SERVICE AVIATION"

By AIR-MARSHAL SIR H. M. TRENCHARD, Bart., K.C.B., D.S.O., *Chief of the Air Staff*

### (a) Introductory Remarks

1. Paper does not deal with details, but seeks to explain some of the principles which are governing the formation and employment of the R.A.F.

### (b) Peace Basis

2. The test of a fighting service is war. This must be the governing factor of all peace organisation. 3. Modern war fought by nations in arms necessitates organisation of fighting services on the cadre principle, with great power of expansion. 4. These conditions are especially difficult for the R.A.F. Expansion very great. Wastage high. Rapid mobilisation essential, as aerial activity will precede contact by land or sea. 5. R.A.F. cannot of itself create reserve of personnel or maintain stocks of material to meet war on the grand scale. Material costly to provide, and to store; also deteriorates and becomes obsolete quickly. 6. R.A.F. is therefore dependent on civil aviation as the Navy is on Mercantile Marine, but to much greater extent. 7. Present situation not satisfactory, but time has been short, and war on grand scale is improbable. Future lies in improvements of aeroplane as means of travel.

### (c) More Immediate Problems

8. More immediate problems are present organisation—provision and career of officers and men—distribution and principles of employment of R.A.F.

### (d) Organisation

9. Present organisation must meet present needs while keeping in view future requirements. 10. Fighting service may be compared to fruit tree. Roots and trunk are raw material in officers, men and equipment, branches are training and depôt organisation, fruit are squadrons. Tree is at present young. To force the crop will retard growth. 11. Demobilisation left many difficulties and blanks. R.A.F. has practically no peace experience behind it, and must learn by trial and error. Criticism welcomed if instructed and constructive.

### (e) Provision of Personnel

12. Efficiency of a fighting service primarily depends on its personnel, their moral discipline, knowledge and contentment. 13. Many questions being asked as to career offered to officers and men. These have been carefully considered, but it is difficult to spread knowledge to individuals. 14. As regards officers, R.A.F. cannot take all on permanent basis. Large number of junior officers required, and comparatively small number of senior officers. Therefore, only proposed to take on permanent basis such number as will be assured of a career. Case would be the same if R.A.F. ceased to exist as a separate service. Original schemes of entry of officers both in R.N.A.S. and R.F.C. recognised this. 15. Disabled pilots not forgotten. Some can be absorbed. Others will obtain disability pensions. Large reduction in number of accidents expected in peace. Work not so intense. Strain less. 16. As regards other ranks, bulk of long apprenticeship trades will be enlisted as boys and given

three years' training. 17. Remainder will be enlisted as men, and given appropriate training. 18. General and vocation education catered for during service with R.A.F. 19. R.A.F. should not therefore be a blind alley, occupation for officers or men entered on a long service basis. 20. Entry of officers on short service basis a more difficult problem. Two sources, viz., direct from civil life and seconded from Army and Navy. 21. Short service officers direct from civil life essential to form reserve for small wars. May prove substitute in some cases for university career. 22. Seconding of officers from Army and Navy as important to those service as to R.A.F. Co-operation between services a certainty. Can only give best results if they know and understand each other. Also most necessary for Army and Navy to study effect of air on their own strategy and tactics.

### (f) Distribution

23. Present widespread unrest leads to dispersion which makes for inefficiency. Small detachments an evil in any fighting force. More than ever so in R.A.F. owing to absence of workshop facilities, difficulties as regards spares and want of supervision by senior officers. 24. Ideal is to concentrate in few centres with power to move rapidly. Latter condition difficult. No air routes. Difficulty of establishing these over foreign countries. Movement by sea slow. Great bulk of material. Shortage of suitable shipping. 25. Attempt made to concentrate in United Kingdom, Egypt and India, but many detachments. It is hoped many of these are only temporary. 26. Importance of Egypt. Centre of unrest shifted from North Sea and Western Europe to Mediterranean and Middle East. Egypt obvious place for central reserve, and has excellent flying climate.

### (g) Employment

27. Absence of literature on the subject. We have, however, experience of the War to guide us, though it is not yet accessible on paper to any extent. Need of R.A.F. Staff College to analyse principles and create school of thought. 28. First principle evolved during War is that multifarious duties of Air Service must be regarded and carried out as single co-ordinated effort. Any other system leads to waste of resources and loss of effect. 29. Second principle is that rôle of aeroplane is essentially offensive. Practically powerless for defensive action. Aerial predominance depends on moral predominance, which can only be acquired and maintained by incessant attack. 30. Constant attack also increases the wearing down effect on enemy's ground troops, and weakens their moral and powers of resistance. 31. Third principle is value of surprise. Difficult to attain. Aircraft must be pushed close up behind the advanced troops to be in readiness to take immediate advantage of fleeting opportunities. 32. Negative principles also evolved. Range of aircraft, readiness for action, independence of communications and absence of obstacles tend to encourage their use. If used without forethought and understanding, and without power of sustained action, aircraft lose their moral effect and achieve small, if any, material results.

## "THE COMMERCIAL AIRSHIP—ITS OPERATION AND CONSTRUCTION"

By COMMANDER SIR A TREVOR DAWSON, Bart., R.N., M.Inst.C.E., M.I.Mech.E.

### I. Introduction

### II. The Case for the Airship

The advantage of the large rigid airship for long-distance communications. The non-rigid airship also useful for surveying and exploration. The respective spheres of the aeroplane and airship; they will not conflict, but co-operate. The airship not yet used for commercial purposes by this country. Experience with passenger airships in Germany before and since the War.

### III. The Operation of Airship Services

The traffic possibilities—passengers and mails; and most suitable routes. The size of airship required. Vital requirements—safety and dependability. Accommodation and

comfort. The influence of weather. The development of the mooring tower. The necessity of training airship pilots. The life and maintenance of airships. Will the cost of operation be reasonable. Need for experiment on a commercial scale. State ownership or private enterprise.

### IV. Airship Construction and Development

The airship suitable for commercial transport has still to be developed. Type of airship required. The need for more reliable engines. The possibility of using less inflammable fuel. Outer cover fabric and gasbags required to withstand tropical conditions. Subjects for experiment and research. The need for cheap production of hydrogen. Time required for construction. Reduction in cost of construction.

### German Aerodrome Buildings at Gotha

It is stated that after protracted discussions with the representatives of the German Government, the Inter-Allied Commission has now agreed that two of the extensive buildings at the aerodrome at Gotha are to be allowed to remain on the condition that they are converted into factory premises. The Germans desired to retain the buildings for civil aviation.

### The "L.113" arrives at Maubeuge

FRANCE has now received the second Zeppelin awarded under the Treaty of Versailles, the "L.113" arriving at Maubeuge on the morning of October 9. The mist was so thick when the airship arrived at 6 a.m. it was decided to postpone the actual landing for three hours. Capt. Huon de Kermadu was in command, and there were 17 German officers and men on board.

# THE OPERATION OF CIVIL AIRCRAFT IN RELATION TO THE CONSTRUCTOR\*

By Mr. H. WHITE-SMITH, C.B.E., Chairman of the S.B.A.C.

In his very valuable paper Mr. White-Smith deals with heavier-than-air craft only, leaving the subject of airships to Commander Sir Trevor Dawson to deal with. Aeroplanes and seaplanes are dealt with, not from the technical but from a business or commercial point of view, and the interdependency of aircraft operator and aircraft constructor is pointed out. The first chapter of Mr. White-Smith's paper deals with the reasons for the present lack of financial success of commercial air services, which he puts down to four main causes: (1) the general public has not yet acquired the air travel habit, regarding it as still being somewhat dangerous; (2) business men are not yet satisfied as to the reliability of aerial services; (3) the present cost is, generally speaking, prohibitive in the case of passengers, being more than double that of the railway fare, for goods traffic it is more than five times as much as fast goods traffic by rail; (4) the comfort of the passengers must be studied, this including the question of taking all the luggage of an average passenger on board the aircraft.

The second chapter of the paper deals with the air habit and the question of safety. It is pointed out that the average Englishman is very conservative, and does not readily take to anything new, and that therefore until he is convinced of the safety of flying he will not fly. Once he satisfies himself as to its safety, he will take to it naturally. The reasons for this belief in the danger of flying are various. Thus in the early days of aviation there were many accidents, and this is still remembered, and the doubt as to its safety lingers in the public mind. Also, whenever there is an aeroplane accident more prominence is given to it by the daily press than to a motor-car accident of equal seriousness. It is pointed out that the Accidents Branch of the Civil Aviation Department has done much good work by its collection and dissemination of information on the subject of crashes, and that the figures published regarding the number of miles flown and the number of passengers carried, compared with the number of accidents, completely refute any suggestion that air travel is still to be regarded as dangerous. Mr. White-Smith states as his opinion that much more publicity must be given to these figures, and that if the daily newspapers cannot give sufficient prominence to them in the news columns, then they must be carefully advertised. The question of forced landings is also dealt with, and it is pointed out that generally speaking passengers are prone to think that they have been in great danger during such a landing, and will go on talking about it to their friends thus doing a great deal of harm. What, therefore, has to be done is to avoid forced landings. These can be divided into two classes—those due to weather, and those due to mechanical defects. The latter should be overcome by a closer co-operation between the designer of the engine and the designer of the machine to ensure that the installation of the engine with its water, oil and fuel is sound. The question of delay or forced landings caused by weather conditions points to the necessity of fitting all machines with wireless telephone, and the writer suggests that there is a great need for an instrument which will indicate the actual height of an aircraft above level ground.

In the third chapter of his paper Mr. White-Smith touches upon the question of the reliability of air services, dividing the subject into two groups—flying by day, and flying by night. As regards the former, there are three distinct problems to be solved before complete reliability is attained. Thus there are the days when the weather is so severe that the machine is unable to leave its aerodrome. Secondly, there are days when fog at the main aerodrome prevents start or landing. Thirdly, there is the case when bad weather is encountered during a flight, and the pilot is unaware what the weather really is ahead of him. Concerning the first case, modern machines have progressed tremendously, but types are still required which can stand up to the severest weather conditions so that nothing but a hurricane could prevent the flight. In the second instance instruments may be forthcoming which will render aircraft even more independent of fog than are other means of locomotion. Mr. White-Smith expresses the opinion that the question of getting off and landing in a fog should be carefully studied by the Aeronautical Research Committee, as it is not a matter in which the constructor can help to any great extent. The

third case will be gradually overcome as fitting of wireless telephone and directional wireless apparatus becomes more general.

Concerning night-flying, the writer points out that it presents even graver problems than does flying by day, and suggests that the Government should carry out a series of experiments to determine the best lighting arrangements for lighting up aerodromes and for landing purposes at night. He also suggests that constructors, in conjunction with lighting experts, should try to evolve apparatus to be carried on board the aircraft which would enable the pilot to light up, from the machine, the ground on which he wished to alight. The advantages of being able to carry on a night service are pointed out, the transit of mail and goods taking place after business hours, and the mail arriving at its destination on the following morning, ready for the opening of the business day. The following is a verbatim report of the remainder of Mr. White-Smith's paper:—

## CHAPTER IV

### *Cost of Operating Commercial Services*

The commercial test of all transport work is necessarily the cost of operation in relation to the receipts obtained, and this same rule applies in equal force to aerial transport service. In order, therefore, to consider the present position, we must get down to figures, and by a study of the operating costs, endeavour to ascertain the directions in which the aircraft constructor may best assist the operator by the development of the right types of aircraft for his transport services.

I propose in the first place, therefore, as an illustration, taking a hypothetical service between London and Paris, and placing before you figures which, as far as I can judge, show the approximate costs of running a commercial air service between these two points.

To obtain a common basis for the comparison of different types of aircraft which might be used and which are today available, I have assumed that six aeroplanes would be employed to their maximum capacity of, say, 1,000 flying hours for one year, and, assuming that the number of flying days is 300 per annum, we have:—

$$\frac{6 \times 1,000}{300} = 20 \text{ flying hours per day,}$$

or 3.3 per day per machine.

This number of flying hours would give, approximately, a service of four machines each way between London and Paris, or eight trips of  $2\frac{1}{2}$  hrs. each, although the slower machines would not accomplish as much as this. These figures may perhaps arouse controversy, but under existing conditions it is probably a fair figure to take, and at any rate will serve as a basis of comparison. It must, however, be recognised that if for any reason it is not possible to average the 1,000 hrs. per machine, the costs will increase proportionately to the short-fall.

It may be said that the comparative figures set out in the statements are not a complete comparison as the different types of machines carry varying numbers of passengers, and the total number carried by a large machine is very considerably more than the number carried by a small machine. I think, however, it will be found that there is not a great difficulty in this respect, as if the small machine is called upon to carry the same number of passengers as the large machine, we must necessarily have a greater number of small machines for the work. This would involve greater capital outlay, and increase all the charges to an extent largely corresponding. It is extremely difficult to find a common basis for comparison, and I have endeavoured to take one that is simple and still as fair as possible.

### *Explanation of Statement of Capital and Operating Charges*

To arrive at the cost of operation we must necessarily take as the foundation the amount of capital expenditure involved in the provision of the aeroplanes and engines, the stock of parts for repairs, machinery and plant, as well as working capital. These are set out in Table A, pp. 1084-5. On reference to this statement, it will be seen that Items 1 and 2 set out the number, horse-power and make of engines. Items 3 and 4 set out the cost of aeroplanes and engines separately. As in some cases the machine were War machines, and can be purchased at disposal prices, I have shown the cost on this basis plus cost of conversion.

In the case of engines, the Puma, Hispano, and Rolls

\* Paper read at the Air Conference on October 12.

engines are also based on disposal figures. Item 5 is the total cost per complete machine. Item 6 sets out the total cost for the six aeroplanes which we propose to use on this service. Item 7 is the value of spare engines necessary, and is based on the provision of a reserve of a third of the total number of engines used in the machines. Item 8 provides for the stock of aeroplane and engine spares which I have calculated on the basis of  $25\frac{1}{2}$  of the value of the complete aeroplanes. If anything, this stock of spares is somewhat on the low side, as it will be seen from the operation figures that the whole stock is used up in the course of a year. Item 9 provides for the capital outlay for the motor transport vehicles at the aerodrome for the handling of various materials supplies, etc. These also would be used for any salvage work that might be necessary. Item 10 provides for machinery and plant at one terminal aerodrome, it being assumed that all the repair work will be carried out at the London end of the service. This figure is also on the small side, as it is assumed that the spares will be purchased as complete components from the Aircraft Constructors, and a minimum of detail constructional work will be carried out in the terminal workshops. Item 11 provides for working capital, which will undoubtedly be necessary for the purchase of supplies, payment of wages, etc., as well as for the amount of fares and freight receipts which are sure to be outstanding from time to time. Item 12 is therefore the total capital outlay in respect of the various types of machines that might be used on the service.

#### Operating Costs

Turning to the next statement also shown on Table A: Items 13 and 14 are the maximum and cruising speeds of varying types of machines, but for the purpose of our calculations we have taken the cruising speed, as it is well known that it is impossible to run aircraft at their maximum speed without involving grave risk of constant breakdowns. Item 15 is the number of passengers carried as a full load by each type of aircraft. In this connection it should be noted that the Airco 9 and 16 have practically no provision for carriage of luggage. In the case of the other machines there is provision for the carrying of a limited amount of hand luggage in addition to the passengers. Items 16 and 17 show the cubic capacity for cargo and the weight of cargo carried in pounds. Item 18 is a statement of general charges, which are set out in detail in Table C, o.1 p. 1087.

If you will refer first of all to Table C, you will see in the first column the general charges set out for all single-engined types, assuming that the charges will be the same for all this class of machine.

Other columns set out the charges for twin-engined machines and multiple-engined machines. It will be seen that certain charges are common to all three classes, but there are other charges which increase proportionately to the number of engines and size of machines. I will not deal with these costs in detail, but you will, no doubt, examine them, and, I think, see that they are reasonable having regard to the service we are operating. Under this heading will be found the charge for rent at the terminal aerodromes. It should be noted that the aerodromes and other facilities are provided by the British and French Governments on payment of a rent charge.

Item 19. *Maintenance*.—This I have divided under (a) *Labour*, the details of which are set out in Table D, on p. 1087. These vary according to whether the type of machine is, single, twin or multiple-engined.

(b) *Spares*.—The spares necessary for upkeep per annum are worked out on the basis of 25 per cent. of the value of machines. This is necessarily an estimate, as no one has any reliable figures to go on. It is probably a fair estimate to take, although it may be somewhat heavy.

Item 20 is for the pilots employed on the services. (a) For the principal pilots on all machines, the charge being calculated on the figure now being paid. (b) For the pilot's assistant at half the pilot's rate. This assistant would be carried only on the twin or multiple-engined machines.

Item 21 is the cost of petrol and oil. This is based on the number of hours flown and petrol is calculated at the new and very heavy price of 4s., while oil is charged according to the class used by the various engines. Item 22 is the cost of insurance of aircraft. I have taken this at 15 per cent. of the value, which is slightly higher than has been quoted to some operating companies, and is slightly lower than has been quoted to others. It may therefore be taken as a fair average figure. If there are any insurance representatives present who are willing to state a lower figure I shall be pleased to amend my figure accordingly. On the other hand, it is conceivable that they may wish to increase the rates.

Item 23 provides for the depreciation of aircraft and engines.

I have based the costs on what are necessarily estimated figures of 2,000 hrs. life for the aeroplane and 3,000 hrs. life for the engine. It is impossible at this stage to lay down with any certainty the length of life aeroplanes and engines will have, but one can safely say that the first estimates made were very much too conservative. Foreign Governments, for instance, have taken as a basis for subsidy that the aeroplane will have a life of only 400 hours. This basis has already been shown to be very wide of the mark, certainly for British-made machines, as there are machines and engines today in good condition and in everyday use which have already flown 800 hrs. Some operators may say that my estimate is too liberal; if so, it will only emphasise the necessity for making such progress in construction as will give the aeroplane and its engine longer life.

Item 24 is for interest on capital, and this I have taken at 10 per cent. Having regard to the present financial position, it will be agreed that this is quite a reasonable figure to take, certainly for Aerial Transport companies. If there are any City men in my audience willing to put up money at a lower rate of interest, I shall be pleased to alter my figure to correspond. Item 25, therefore, gives the total cost for the six machines for a total of 6,000 flying hours. Item 26 is the cost per flying-hour per machine. Item 27 is the cost per aircraft mile. Item 28 is the cost per passenger mile. Item 29 is the cost per passenger journey at 100 per cent. load factor; that is, the cost of taking one passenger from London to Paris, assuming that each type of aircraft travels with a full passenger load. Item 30 is the same cost, assuming that the aircraft is only three quarters full. Item 31 is a similar calculation based on the aircraft being only half full. Items 32 and 33 show the cost per ton/mile and the cost of carrying 1 lb. of goods on the journey with the different load factors.

I have shown three distinct load factors, as in this way the importance of obtaining as high a load factor as possible is clearly demonstrated. No transport company could possibly rely on a 100 per cent. load factor, but it will probably be found that the true load factor lies somewhere between the 50 per cent. and 75 per cent. mark.

Item 37 shows the cost per cubic foot of cargo per journey in each type. It is very important that the cubic capacity should be as large as possible, as taking a machine, for instance, such as the Airco 9, although it is able to carry a useful load of 500 lbs., its cubic capacity is so small that, with ordinary freight, not more than 300 lbs. could be carried. It is therefore necessary for the space provided to be correlated to the weight of cargo to keep a low cost under this heading.

This brings us to the end of our statement, but in addition to the above items, it will be noted that there is a terminal transport charge of 1/- per passenger journey which has to be added to the flying costs above. As this charge depends entirely upon the number of passengers who have to be taken from London to Croydon and from Le Bourget to Paris, while, of course, it cannot be omitted, I have not added it to the flying costs, but show it separately.

Items 38 and 39. While I am not dealing with the question of receipts or revenue, I have shown at the foot of Table A a statement of the fares and charges at present in force on the London-Paris Services, both air and rail. It should be borne in mind that the services of booking agents for the air service have to be paid for, and this is done by their deducting 5 per cent. to 10 per cent. from the fares and freight charges.

Having dealt with the capital expenditure involved and the cost of operating, we now come to consider the effect of the figures which are laid before us.

#### Remarks on Cost of Working

It must be realised that these figures are necessarily estimated, and not the product of actual working. I doubt very much whether the companies already operating would care to disclose their actual figures of cost, and, even if they did, it would only be for the type of machine they were actually using. The comparisons made, therefore, may not be altogether fair. For instance, we have taken the depreciation and insurance at the same rate for all types of machines. This does not bring into consideration any advantage which the twin-engined machine, and certainly the multiple-engined machine, may have in point of reliability. If, for instance, the "Bristol" triplane, as the result of being fitted with four engines, is more reliable in service, and has fewer crashes, then the rate of insurance would undoubtedly be reduced. Correspondingly, the rate depreciation and cost of maintenance would not be as heavy. These factors of reliability are, however, so difficult to reflect in an estimate of this character that I have not attempted

to do it, and some of the machines may, therefore, suffer unfairly, in the comparison, as these good qualities of reliability and safety, which go to make the first high capital cost, are not reflected by lower operating charges, as no doubt they would be in actual service, and so justify the first heavier capital cost. Then again there is nothing to indicate the comparative values of the comfort and convenience of the different machines.

It has been said that "Comparisons are odious," and one feels under some difficulty in making comparisons of the types of machines produced by various makers. I have, however, endeavoured to deal impartially with the figures, and if some of the machines or engines come out apparently unfavourably from the constructor's point of view, I hope the effect of the comparison will be to assist those constructors to develop their new types more efficiently. In any case, it is open to any prospective transport company to make out a similar statement should they so desire, and there is therefore nothing to be gained by anyone objecting to the comparisons.

One fact that emerges from this statement is the comparatively higher cost of operating machines which were originally designed for war purposes, and which have more or less been completely re-modelled for civil transit. I have marked these machines in the statement. This is more especially the case with the single-engined machines as the twin-engined and multiple-engine machines have the advantage of spreading the charges over a greater number of passengers or a greater amount of cargo. The statement, however, shows that progress has already been made since the end of the War. Moreover, we are only dealing with machines which are at present available, but I am glad to say there are other machines in course of construction which will show results of a still greater efficiency. The costs, then, under examination should be still further reduced, and the possibility of a service such as we have considered being placed on a paying basis will be brought appreciably nearer.

Examining the statement more closely, we see that the cost per flying hour and per aircraft mile lead us on to the true test of efficiency in our comparison, *i.e.*, the cost per passenger/mile or cost per ton/mile. Taking the cost per passenger/mile first, it is perhaps better visualised by a comparison in which the definite distance, *viz.*, 240 miles, is considered, and, in order that we may talk about probabilities, we will take the load factor of 75 per cent., and the figures under Item 30.

On reference to the comparisons under this heading, you will see for example an interesting state of progress in the case of the Airco machines. Whereas the Airco 9's cost for the journey is £17 10s., the Airco 16 is £13 4s. The latest type, Airco 18, comes out at £7 4s.

Another point that will be noticed is that, whereas in some cases the passenger cost is comparatively high, the cost per ton/mile does not bear the same ratio. For example, it will be seen under Item 30 that whereas the cost per passenger journey on the 0/400 Handley Page is £11 8s., which is but little higher than the "Bristol" triplane, the cost per ton for the journey is £95 16s. for the former machine, while it is only £50 5s. for the latter machine. This result is brought about by the fact that the carrying power of the "Bristol" triplane is not being fully utilised in carrying only fourteen passengers, and that the allowance of a considerable amount of room for the comfort of the passengers in this machine is being paid for by a higher running cost. If, however, we were utilising its full weight-carrying capacity, we should get a more efficient cost figure.

In this connection too it will be seen that the W.8 Handley Page shows a substantial improvement on the 0/400, the passenger figure being £7 14s. 6d., and the cargo figure being £44 19s. Another interesting fact is apparent, and that is that the cost per cubic foot of cargo may also vary in different ratios to the cost per ton/mile, *i.e.*, we may be able to carry a certain weight, but if the cargo is of a bulky character there may not be sufficient cubic capacity to hold it. We find, therefore, that ample cargo space fully utilised may reduce our figure. A further most important fact jumps to our notice, that is, the high proportion which the cost of petrol bears to our total costs.

I have purposely not gone into the question of the fares and rates charged. It is the other side of this subject, and the corollary to the side we have been considering. The two sides of the business are interwoven. The fares and rates you charge are governed by what can be properly charged, and what the travelling public will pay for the particular services rendered. The charges must be so based as to attract a sufficiency of public support to economically spread the standing charges of the undertakings. On the other hand the fares and rates charged must, to make the business successful,

provide a margin of profit over and above all the operating costs and other charges. It follows, therefore, that the lower we can bring our working costs the lower are the fares that can be charged, the more attractive to the public will the services be, and more generally used, with a consequent greater success in every direction.

To sum up this chapter, the figures I have shown clearly demonstrate that even with high load factors existing types of machines can show little, if any, profit. The demands, therefore, come to the aircraft and engine constructors for continued progress.

#### CHAPTER V.

##### *Future Demands of the Transport Operators on the Aircraft Constructor.*

###### 1. *Passenger Aeroplanes.*—Taking as our first type the passenger machine:—

This machine may be of varying size, but there are certain qualities called for in all. The essential qualities are Safety First and then Reliability. I do not propose to go into details of how those qualities shall be attained. The constructors and their designers know perfectly well what is called for under these headings. All I would urge is that they are essentials.

Turning to the other qualities, on which there is considerable scope for variation, there is the question of comfort. Already in the modern aeroplane this has been catered for to a very fair extent, and it must be still further developed. It not only makes air journeys more agreeable, but it has the effect even of inspiring confidence. In connection with this same question of comfort there is a desirable feature called for, *viz.* : The suppression of the present deafening noises of the engine, propeller, etc. Air travelling will be greatly popularised if these noises could be eliminated.

The question of speed, and by this I mean cruising speed, is of great importance. Speed is the asset of the aeroplane, and, while the present cruising speeds of about 100 m.p.h. are satisfactory, it would appear that every endeavour should be made to increase this quality in aircraft provided always that it is not brought about at the expense of economy. With regard to the range of flight, it will probably be found that 350-400 miles is ample for ordinary passenger services, as undoubtedly these services will be worked on the relay system, and the stages are unlikely to be greater than about 300 miles. Moreover, until the aeroplane has reached a much greater perfection of comfort passengers are hardly likely to be willing to stay on board for extended periods.

Another quality, *viz.*, economy of running, as we have already seen, is forced on us by the consideration of cost. Obviously the most effective way of reducing our costs will be to increase the useful load carried while still using no greater horse power. In other words if we can lift double the weight for the same horse power without detracting from our speed we should be in a position to run our services on profit-earning lines. With regard to the size and carrying capacity of the machine, this must be governed from time to time by the demands which are made on the transport companies for passenger accommodation. It is obvious from our figures that it is economical to use the machine which, in service, most closely approximates to the amount of traffic to be carried so as to produce a 100 per cent. load factor. The constructor must necessarily be guided on this point by the requirements of the transport companies, who will no doubt call for larger and larger machines as the passenger traffic develops. Wireless equipment we have already said is essential for all future types of aircraft.

###### 2. *Mail and Light Goods Aeroplanes*

In common with the passenger machine safety and reliability come first, but the special feature of this machine will, no doubt, be its speed. The probable cruising speed of this machine would be not less than 120 m.p.h.

Using these machines in relays, Continental capitals such as Rome, Madrid, Vienna, Berlin, Constantinople and Warsaw would be reached during the night.

To work on the relay system, it is essential that a system of standardised mail or goods containers should be adopted. The fuselage should be so constructed that containers or boxes could be filled with the mails or parcels at the G.P.O. and sent straight down to the aerodrome and placed in the aeroplane without delay of further handling. At the end of the first stage these containers would be transferred to the waiting machine and, being standard, should fit exactly into place, the transfer being thus only a matter of minutes, and that machine would pass on to the next machine, and so from stage to stage. I think it is quite obvious that, when long aeroplane services are operating, involving either changing mails or goods from one machine to another several times, such a system will be essential, and it is most desirable that the Air Ministry,

postal authorities and the transport companies in England and abroad should meet together to standardise the measurements so that all aircraft used for these purposes should meet the requirements laid down.

Wireless should be fitted to this class of machine and adequate landing and signal lights should be provided. A sufficient range for this machine would probably be 400 miles. It is again necessary to have a high useful load factor in relation to the speed. No doubt the postal machine will develop in the future to permit of the carrying of considerable quantities of mails, and it will then be necessary to have ample room on the aeroplane for sorting the mail *en route*.

### 3. Heavy or Bulky Goods Aeroplane

The next type that is likely to be called for is an aeroplane to carry heavy or bulky goods.

It may be questioned whether there is a call yet for this class of machine, but it should not be overlooked that the aeroplane offers the advantage of practically door-to-door transport, avoiding transhipment *en route*, so that there may be certain classes of even heavy goods which would be prepared to pay the higher rates still necessary for air transport. The heavier goods traffic cannot be greatly developed until the right type of machine is brought out to cope with this particular class of traffic on freight rates that are comparable, having regard to all the advantages with rail and sea transport.

This machine should, in my opinion, differ very considerably from the previous two machines which we have already considered. Here we no longer have the necessity for high speeds. The goods traffic could be handled almost entirely by night and would not be so liable to have to fly in high winds, and even should it on occasion have to do so, the fact that the machine would be late would not be of the same vital importance. The approximate performance might therefore quite well be a cruising speed of about 70 m.p.h., with a range of say 500 miles.

The essential feature of this machine would be ability to carry a heavy useful load per horse power, and this, combined with economy, would have to be studied more closely than ever to bring the operating costs down to allow of charges comparable with rail or sea rates and so enable this class of traffic to be catered for. It would appear that a fairly large machine will be necessary for this work, and it is important that the cubic capacity of the machine should be correctly correlated to the weight carried. For certain classes of goods it may be that the machine would have to be specially designed, but it can only be economical in operation if this is observed. Wireless should be fitted, and, as this machine will operate by night, it will also be necessary to provide it with efficient landing and signal lights. The question of containers may, in some instances, also affect this class of machine. Safety and reliability are again essentials of this type as of the previous types.

### General Points Common to all Types

There is also a point we have not yet dwelt upon, viz., that of getting off and landing in confined spaces. The capacity to do this will most certainly add to the value of the aeroplane as the number of centres from which it may operate would be greatly increased, to say nothing of the advantage gained in the cases of forced landings. An ideal to be aimed at for the not distant future is that aircraft may be able to come down on and rise from such small spaces as will make it possible for them to operate from the centres of our large towns. The time at present spent in getting to and from terminal aerodromes takes away much of the advantage of the speed across country, and on short distances this is an important factor.

There is another point which affects all three classes of aeroplanes which we have discussed, and that is whether provision shall be made for more than one pilot. In the case of small machines probably one pilot will be sufficient, but the whole tendency is that the machines be of a medium or large size, and it certainly appears desirable that the pilot should have an assistant. The assistant might be another pilot or an engineer or navigator, or, in the case of very large machines, all these officers might be part of the crew.

### Low First Costs for Three Types

Before leaving this subject I must refer to the very commercial question of the need for the price or first cost being as low as possible, always consistent, however, with the maintenance of the highest possible standard of construction—a quality which we can never, in aircraft construction, sacrifice for any consideration.

A low first cost not only affects initial capital outlay, but afterwards affects insurance, depreciation, and maintenance as it follows that, if the price of an aeroplane is low to begin with, the cost of spare parts will be correspondingly low.

How low constructional cost may be achieved is for our designers to consider, but it is interesting to note that there seems to be a distinct tendency to the use of monoplanes in place of biplanes. The development, therefore, of simplified shapes may possibly assist in this direction.

The demands of the constructor set out in this chapter of my paper can, no doubt, be greatly amplified. The time does not permit of my enlarging on them, but I do hope that in the course of our discussing today other points may be brought out. I would further add that it can only be of the greatest assistance if the transport companies themselves would formulate their requirements for the guidance of the constructors.

### CHAPTER VI.

#### Present Position of Seaplanes, Flying Boats and Amphibians

In speaking of the first two of these classes of sea aircraft I will, for the purpose of brevity, use the term "seaplanes."

In studying the position of seaplanes one is immediately struck by the fact that at any rate so far as the British Isles are concerned, they have not taken any place commercially in the Air transport world.

This apparent stagnation is, I think, very easily explained. First of all, at the end of the War there were few seaplanes available for sale at low prices, as was the case with aeroplanes. Such seaplanes as were available were in no way suitable for commercial work. Again, there was no obvious service for a transport company to operate such as the London-Paris Service, and it is difficult to conceive of any service from this country where it could reasonably be expected to provide loads at the rates which would have to be charged both for passengers and goods, although it seems quite possible that a service if run from the heart of London to Amsterdam could be equally well served with seaplanes as aeroplanes. In this case, however, the difficulty would arise of providing slipways and sheds at both terminal points, which would involve in these cities a very heavy capital expenditure, and in view of the fact that the seaplanes at present on the market cannot be called commercial, it is obvious that such an undertaking could not expect to meet with success.

Again, it must be remembered that the aeroplane has had definitely more advertisement than the seaplane. During the War thousands more aeroplanes have been built than seaplanes, and there was therefore greater concentration on the development of the aeroplane: consequently the design of the seaplane has not progressed to the same extent as that of the land machine.

#### Capital Expenditure and Operating Costs

It will, perhaps, be interesting to take a few of the existing types of seaplanes and compare the cost per passenger journey with that of the aeroplane. In order to make as far as possible a fair comparison I have again taken a fleet of six machines each operating 1,000 hours per annum, in exactly the same way as I have already illustrated the aeroplane. I am in some difficulty, however, as there is so little data, if any, to work upon and it is exceedingly difficult to arrive at anything but very approximate figures.

The statement would not be up-to-date without the inclusion of the Amphibian—this being the term which describes the flying machine which operates equally well from sea or land. The recent practical development of this type is full of interest and holds promise of being able to fill a most useful purpose in various parts of the world.

Turning then to Table B, p. 1086, I have shown the capital outlay involved in operating different types of seaplanes and amphibians. The headings are, on the whole, similar to those I have used for the aeroplanes, and I do not think it necessary to comment at length upon them, except to remark that there are not as yet the same terminal facilities available for the seaplane as have been provided by the Government for the aeroplane. A provision has, therefore, been made under capital expenditure in respect of slipways and sheds. The effect of this is to add an annual charge of about £3,000 to the operating costs of single-engined seaplanes as compared with single-engined aeroplanes. Table B also shows the operating costs, which again are worked out in a similar manner to those shown in Table A. The general charges for the single-engined type of machine and for the twin-engined machine are given in the last two columns of Table C.

F.2, a seaplane, is a fighting machine, and the costs have therefore worked out on the assumption that it would be converted to civil work. The labour required to maintain the seaplanes I have taken as being identical with that required for the aeroplanes, and will be found set out in Table D.

#### Relative Costs of Seaplanes and Aeroplanes

Taking item 30—the cost of a passenger journey of 240 miles with a 75 per cent. load factor—we arrive at a figure

which I think can usefully be compared with the cost of carrying a passenger on a similar journey by aeroplane. These figures show up the seaplane very unfavourably as compared with the aeroplane. In this connection it will be seen that the amphibian does show some improvement.

The reason that the seaplane costs far more to run per passenger mile than the aeroplane is, I think, very obvious. The speed of the sea craft is much less than that of the aeroplane, and this factor plays an important part in determining the cost per mile. Comparing the two types the position would appear to be either: (a) That a sea craft of a given horse-power cannot obtain as good a performance as a land machine of a similar horse-power; or (b) that the present design of aeroplane is much in advance of the present design of seaplane.

It may be that seaplanes have been designed with better performances than the machines I have taken to arrive at the relative costs, but, to the best of my knowledge, there have as yet been no other British seaplanes or amphibians produced which would show better figures than those of the machines I have taken. All the aeroplanes reviewed are those actually available or in use today. Commercially, therefore, in such countries where there is the alternative of operating a seaplane service or an aeroplane service between the same points, it appears that today the aeroplane would have the advantage over the seaplane.

On the other hand, there are many places abroad where aerodromes do not exist, and would have to be made at considerable expense, where the seaplane would have definite advantages over the aeroplane, and I would suggest that constructors of commercial seaplanes would be well advised to concentrate on producing machines which could be used abroad where provision of aerodromes is the chief difficulty. So far as England is concerned, it seems difficult to see in what directions the seaplane could usefully be employed in competition with the aeroplane, at least for some years.

Frankly speaking, the seaplane position is disappointing, and there is the vital necessity for improved design.

#### *Demands on Seaplane Constructors*

It is very difficult to formulate the demands which will come to the seaplane constructor. In the first place there are practically no seaplane transport services in operation, and therefore little experience to go on. The probable demands as regards safety, reliability, comfort and seaworthiness are well set out in the conditions for the Air Ministry Amphibian Competition, and these still apply. In addition, however, the same demands exist for the reduction of running costs as apply to the aeroplanes which we have already considered, and, generally speaking, the same remedies, either aerodynamical or to do with the engine apply. The Government competition for Amphibians has brought before us what is quite a new development, and has produced dual-purposed machines of a very practical character. There is undoubtedly a great field for the use of the amphibian, and its development cannot but be valuable, and provide a type of machine which will meet particular demands. In such countries as Canada, Norway and other parts of the world where there are water areas conveniently placed in centres of population this class of machine will be of great service.

#### CHAPTER VII

##### *Aircraft Engines.—Defects of present Types*

We now come to the vital question of the aircraft engine, the heart of the machine. The engine of today is a splendid production, and the advances made by our engine constructors in power, weight reduction, economy, etc., are very marked as compared with the pre-War product. Should I suggest, however, that the aircraft engine of today is still not reliable, I have no doubt that a storm of protest might be directed at me from the leading aircraft engine designers, and these protests, looking at it from one point of view, might be justified. That is to say, the aircraft engine of today cannot in any way be compared with the engine of four or five years ago, but the fact remains that to this day accidents do occur which are due to mechanical failure.

##### *Reliability and Weight*

It must be recognised that none of the existing engines were designed for commercial transport, and it is quite possible by reason of designing to meet war requirements that the engine of today has sacrificed some of its reliability and its durability to obtain high horse-powers with a low weight. For civil aviation reliability is an absolute necessity, and I suggest it may be desirable to increase the weight per horse-power in order to obtain greater reliability. Again, in order to keep down the weight of the engine, very specialised materials have to be employed, which must have raised the price of the engine to a considerable extent. If by slightly

increasing the weight per horse-power a longer life with a lower initial cost can be obtained our capital and operating costs will benefit. The high capital outlay involved in starting aerial services must to an extent stop the formation of operating companies, and this question of initial cost is undoubtedly one of the drawbacks which exist today.

##### *Engine Starters*

An important improvement which is necessary for aircraft engines is the incorporation of an efficient engine starter. The provision of a proper starter has been sadly neglected, and the methods of starting up engines are still most primitive. Each aircraft engine produced by our engine constructors should have supplied with it an apparatus which would enable the engine to be started from the fuselage without difficulty. Until this equipment is provided with every engine commercial aircraft will be subject to aggravating delays in starting engines, which will prevent their running to a scheduled time table.

##### *Engine Silencing*

Another point that should be studied is the question of the silencing of the engine. Very little has been done in this direction, mainly owing to reluctance to unnecessarily load up the machine, and for war purposes it was not essential. For civil use it becomes an essential, at any rate as far as passenger machines are concerned, and the discomfort to passengers while engines run with open exhaust must always be great, and while yet all other noises such as the whirl of the propeller and the whistling of the streamline wires of the machine through the air may not be eliminated, if the engine noises could be suppressed it would certainly add to the comfort and the confidence of the passengers.

##### *Call for Engines on Different Principle*

Up to the present we are entirely dependent on the petrol engine. There is no other aircraft engine available, and there is, therefore, the call for constructors of all classes of power-producing machinery to consider whether some other form of engine is not possible. It may be that engines of the Diesel type, or some other class of engine which uses oil fuel of a cheap nature, will evolve, but the necessity in the development of engines for commercial aircraft is pressing.

##### *Fuel Economy*

The need for fuel economy has been brought forcibly before us as we considered the operating costs, and a constant improvement on existing types in this respect is one of the best contributions that the engine constructor can make to the success of the transport services.

Our figures show how great a proportion of our total cost is spent in petrol. Taking a general line through the various types, we see it represents approximately one-third of the total charges, and it is the largest item of all. The need, therefore, for engines that are economical is vividly brought home to us. Every gallon saved in consumption is of value, and there is still room for great saving. If only a real reduction could be effected we should begin to turn our losses into profit.

Not only does economy reduce the money cost, but it allows the alternative of useful load of passengers or cargo being carried in place of fuel; thus it has a double value in air transport.

##### *High Cost of Petrol*

The figures also emphasise how seriously air transport is hit by the price and from time to time by the advances that are made by the sellers of petrol spirit. There seems little prospect of reduction, and in fact there is the serious possibility of further rises. No other form of transport is so vitally affected or suffers to a proportionate extent.

The call, therefore, for research to find other fuels comes from the aircraft users more strongly and urgently.

In this connection I should urge that every support possible should be given to the various research and other committees in their work of bringing commercial alcohol and other fuels into the field of everyday use.

Our future, to a large extent, is bound up in finding another fuel—one of at least equal efficiency and much lower cost—and no stone should be left unturned to obtain this result.

#### CHAPTER VIII

##### *Aircraft and Engine Maintenance and Repairs in Service.—Accessibility and Simplicity of Construction*

In addition to the particular qualities we have already set out as being desirable for aircraft and aircraft engines, there is another essential, namely, that they should be so designed as to provide such accessibility for repairs as will save the time of the maintenance staff and also allow of any running repairs being carried out with facility. The effective daily overhaul of the aircraft and engine is the foundation of success of the flying services.

TABLE A.—AEROPLANES

Names of Machines ..	Airco 9.†	Airco 16.	Airco 18.	Bristol Tourer.†	B.A.T.	Westland Hispano.	Westland Lion.
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## CAPITAL EXPENDITURE.

Six machines, each flying 1,000 hours per annum.

1. No. of engines ..	1	1	1	1	1	1	1
2. Horse-power and make of engines ..	240 h.p. Puma	275 h.p. Rolls (Mark VII)	450 h.p. Lion	240 h.p. Puma	350 h.p. Rolls	300 h.p. Hispano	450 h.p. Lion
3. Cost of aeroplane ..	£500†	£2,400	£4,500	£1,000†	£2,900	£2,300	£3,000
4. Cost of engines ..	£350†	£1,600†	£2,000	£350†	£1,600†	£600†	£2,000
5. Cost per machine ..	£850	£4,000	£6,500	£1,350	£4,500	£2,900	£5,000
6. Total cost of six aeroplanes ..	5,100	24,000	39,000	8,100	27,000	17,400	30,000
7. Spare engines ..	700	3,200	4,000	700	3,200	1,200	4,000
8. Stock of aeroplane and engine spares—25 per cent. of value of machines ..	1,275	6,000	9,750	2,025	6,500	4,350	7,500
9. Aerodrome transport vehicles ..	2,000	2,000	2,000	2,000	2,000	2,000	2,000
10. Machinery and plant at terminal aerodrome ..	2,000	2,000	2,000	2,000	2,000	2,000	2,000
11. Working capital (two months' running cost) ..	8,940	13,120	15,540	9,385	13,523	11,415	14,169
12. TOTAL CAPITAL OUTLAY ..	£20,015	£50,320	£72,290	£24,210	£54,225	£38,365	£59,669

## STATEMENT OF COST.

Of operating six machines each flying 1,000 hours per annum.

13. Maximum speed ..	... m.p.h.	112	113	125	115	110	115	117.7
14. Cruising speed ..	... m.p.h.	95	95	105	95	90	95	100
15. Number of passengers, full load ..	...	2	4	8	2	4	3	5
16. Cubic capacity for cargo ..	cubic ft.	30	80	200	32	36	112	115
17. Full cargo load ..	lbs.	500	800	2,000	600	1,200	680	1,700
18. General charges (see Tables B, C and D of Appendix) ..	£	18,160	32.6	18,160	21.7	18,160	18.160	25.1
19. Maintenance—	£		cost.	£	cost.	£	cost.	£
(a) Labour (see Table E of Appendix) ..	6,680	12.0	6,680	8.0	6,680	6.6	6,680	11.4
(b) Spares, based on 25 per cent. of value of machines ..	1,500	2.7	6,000	7.2	9,750	9.7	2,250	3.8
20. Pilots at £1 per hour plus retaining fee ..	6,800	12.2	6,800	8.1	6,800	6.8	6,800	11.6
20A. Pilot's assistant, 10s. per hour plus retaining fee ..	—	—	—	—	—	—	—	—
21. Petrol and Oil—6,000 hours (petrol charged at 4s. per gall.) ..	17,500	31.5	27,060	32.3	28,500	28.4	17,500	29.8
22. Insurance of aircraft at 15 per cent. ..	765	1.4	3,600	4.3	5,850	5.8	1,215	2.1
23. Depreciation of machines—	£			£		£		£
3,000 flying hours—engines ..	2,200	4.0	10,400	12.4	17,500	17.4	3,700	6.3
2,000 flying hours—aeroplanes ..	2,001	3.6	5,032	6.0	7,229	7.2	2,421	4.1
24. Interest on capital, 10 per cent. ..	2,001	3.6	5,032	6.0	7,229	7.2	2,421	4.1
25. SIX MACHINES, 1,000 HOURS EACH. TOTAL OPERATING CHARGES* ..	£	55,606	100.0	83,732	100.0	100,469	100.0	58,726
26. Cost per flying hour per machine ..	£ s. d.	9 5 0	£ s. d.	13 19 0	£ s. d.	16 15 0	£ s. d.	9 16 0
27. Cost per aircraft mile ..	£ s. d.	0 1 11 1	£ s. d.	0 2 11 1	£ s. d.	0 3 2 1	£ s. d.	14 9 0
28. Cost per passenger mile ..	£ s. d.	0 0 11 1	£ s. d.	0 0 9	£ s. d.	0 0 4 4	£ s. d.	0 0 9 1
29. Cost per passenger per journey of 240 miles on 100 per cent. load factor ..	£ s. d.	11 14 0	£ s. d.	8 16 0	£ s. d.	4 16 0	£ s. d.	12 7 0
30. Cost per passenger per journey of 240 miles on 75 per cent. load factor ..	£ s. d.	17 11 0	£ s. d.	13 4 0	£ s. d.	7 4 0	£ s. d.	18 10 6
31. Cost per passenger per journey of 240 miles on 50 per cent. load factor ..	£ s. d.	23 8 0	£ s. d.	17 12 0	£ s. d.	9 12 0	£ s. d.	24 14 0
32. Cost per ton of cargo per mile ..	£ s. d.	0 8 8 2	£ s. d.	0 8 2 4	£ s. d.	0 3 7	£ s. d.	0 7 8 2
33. Cost per ton per journey of 240 miles ..	£ s. d.	10 4 14 0	£ s. d.	9 8 14 0	£ s. d.	4 2 18 0	£ s. d.	9 2 9 0
34. Cost per lb. of cargo per journey of 240 miles on 100 per cent. load factor ..	£ s. d.	0 0 11 1	£ s. d.	0 0 10 2	£ s. d.	0 0 4 8	£ s. d.	0 0 10 0
35. Cost per lb. of cargo per journey of 240 miles on 75 per cent. load factor ..	£ s. d.	0 1 5	£ s. d.	0 1 4	£ s. d.	0 0 7	£ s. d.	0 1 3
36. Cost per lb. of cargo per journey of 240 miles on 50 per cent. load factor ..	£ s. d.	0 1 10 2	£ s. d.	0 1 9 2	£ s. d.	0 0 9 2	£ s. d.	0 1 3 1
37. Cost per cubic ft. of cargo per journey of 240 miles on 100 per cent. load factor ..	£ s. d.	0 15 7	£ s. d.	0 8 9 2	£ s. d.	0 4 0 2	£ s. d.	0 15 5 1

## COMPARATIVE STATEMENT OF PRESENT CHARGES ON LONDON-PARIS ROUTE FOR PASSENGERS AND GOODS

38. By Air Line ..	Passengers (Single). £10 0 0s		Passengers (Return). £18 18 0s		Parcels. 1s. 3d. per lb. 8s		Goods. 1s. 3d. per lb. 8s	
	1st Class. £3 15 8	2nd Class. £2 12 4	1st Class. £7 11 4	2nd Class. £5 4 8	Varying from 4d. to 14d. per lb.	14d. per lb. (Grande Vitesse)		
39. By Rail and Steamer (Dover-Calais Route) ..								

\* Subject to an addition of 1s per passenger for terminal motor transport.

† Indicates aeroplanes originally constructed for war purposes.

‡ Indicates figures based on disposal prices plus cost of conversion to civil use in case of aircraft.

Receipts from these charges are subject to a deduction of from 5 per cent. to 10 per cent. by booking agents.

TABLE A.—AEROPLANES—*continued*

Names of Machines . . . . .	Martinsyde Hispano.	Handley Page 0-400.†	Handley Page W.8.	Vickers Vimy.†	Boulton and Paul Bourges P.8.†	Bristol Triplane.†
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CAPITAL EXPENDITURE (*continued*)

## Six Machines, each flying 1,000 hours per annum

1. No. of engines . . . . .	1 300 h.p. Hispano	2 350 h.p. Rolls	2 450 h.p. Lion	2 350 h.p. Rolls	2 450 h.p. Lion	4 400 h.p. Liberty
2. Horse-power and make of engines . . . . .	£2,500	£2,800‡	£9,000	£6,800	£6,000	£13,500
3. Cost of aeroplane . . . . .	£600	£3,200‡	£4,000	£3,200‡	£4,000	£4,000
4. Cost of engines . . . . .						
5. Cost per machine . . . . .	£3,100	£6,000	£13,000	£10,000	£10,000	£17,500
6. Total cost of six aeroplanes . . . . .	£18,600	£36,000	£78,000	£60,000	£60,000	£105,000
7. Spare engines . . . . .	£1,200	£6,400	£8,000	£6,400	£8,000	£8,000
8. Stock of aeroplane and engine spares—25 per cent. of value of machines . . . . .	4,450	9,000	19,500	15,000	15,000	26,250
9. Aerodrome transport vehicles . . . . .	2,000	2,000	2,000	2,000	2,000	2,000
10. Machinery and plant at terminal aerodrome . . . . .	2,000	3,000	3,000	3,000	3,000	5,000
11. Working capital (two months' running cost) . . . . .	11,500	21,165	27,820	24,635	25,115	40,110
12. TOTAL CAPITAL OUTLAY . . . . .	£39,810	£77,565	£138,320	£111,035	£113,115	£186,360

STATEMENT OF COST (*continued*)

## Of operating six machines each flying 1,000 hours per annum.

13. Maximum speed . . . . . m.p.h.	125	85	119	103	140	134
14. Cruising speed . . . . . m.p.h.	105	70	100	90	116	105
15. Number of passengers, full load . . . . .	4	10	14	12	7	14
16. Cubic capacity for cargo . . . . . cubic ft.	36	400	500	300	200	570
17. Full cargo load . . . . . lbs.	1,200	1,800	3,600	2,240	2,000	4,400
18. General charges (see Tables B, C, and D of Appendix) . . . . .	£18,160	£24.8	£20,500	£15.2	£20,500	£12.7
19. Maintenance— (a) Labour (see Table E of Appendix) . . . . .	6,680	9.1	12,570	9.3	12,570	7.9
(b) Spares, based on 25 per cent. of value of machines . . . . .	4,450	6.1	9,000	6.7	19,500	10.8
20. Pilots at £1 per hour plus retaining fee . . . . .	6,800	9.3	6,800	5.0	6,800	3.8
20A. Pilot's assistant, 10s. per hour plus retaining fee . . . . .	—	—	3,800	2.8	3,800	2.1
21. Petrol and Oil—6,000 hours (petrol charged at 4s. per gall.) . . . . .	21,780	29.6	54,120	40.2	57,000	31.5
22. Insurance of aircraft at 15 per cent. . . . .	2,790	3.8	5,400	4.0	11,700	6.5
23. Depreciation of machines— 3,000 flying hours—engines . . . . .	8,700	11.9	14,800	11.0	35,000	19.4
2,000 flying hours—airplanes . . . . .	3,981	5.4	7,756	5.8	13,832	7.7
24. Interest on capital, 10 per cent. . . . .					11,103	7.0
25. SIX MACHINES, 1,000 HOURS EACH. TOTAL OPERATING CHARGES* . . . . .	73,341	100.0	134,746	100.0	180,702	100.0
					158,893	100.0
26. Cost per flying hour per machine . . . . .	£ 12 4 6	£ 22 9 0	£ 30 2 0	£ 26 10 0	£ 27 0 0	£ 43 4 0
27. Cost per aircraft mile . . . . .	0 2 4	0 6 5	0 6 0 1	0 5 10 1	0 4 8	0 8 2 1
28. Cost per passenger mile . . . . .	0 0 7	0 0 7 1	0 0 5	0 0 6	0 0 8	0 0 7
29. Cost per passenger per journey of 240 miles on 100 per cent. load factor . . . . .	7 0 0	7 14 0	5 3 0	5 18 0	8 0 0	7 1 0
30. Cost per passenger per journey of 240 miles on 75 per cent. load factor . . . . .	10 10 0	11 8 0	7 14 6	8 15 0	11 17 0	10 10 0
31. Cost per passenger per journey of 240 miles on 50 per cent. load factor . . . . .	14 0 0	15 8 0	10 6 0	11 16 0	16 0 0	14 2 0
32. Cost per ton of cargo per mile . . . . .	0 4 4	0 7 11 1	0 3 9	0 5 10 1	0 5 2 1	0 4 2 1
33. Cost per ton per journey of 240 miles . . . . .	52 0 0	95 16 0	44 19 0	70 13 0	62 11 0	50 5 0
34. Cost per lb. of cargo per journey of 240 miles on 100 per cent. load factor . . . . .	0 0 5 1	0 0 10 1	0 0 5	0 0 7 1	0 0 6 1	0 0 5 1
35. Cost per lb. of cargo per journey of 240 miles on 75 per cent. load factor . . . . .	0 0 8 1	0 1 3 1	0 0 7 1	0 0 11 1	0 0 10	0 0 8 1
36. Cost per lb. of cargo per journey of 240 miles on 50 per cent. load factor . . . . .	0 0 11	0 1 8 1	0 0 10	0 1 3	0 1 11	0 0 11
37. Cost per cubic ft. of cargo per journey of 240 miles on 100 per cent. load factor . . . . .	0 15 7	0 3 10 1	0 2 10 1	0 4 8 1	0 5 7	0 3 5 1

\* Subject to an addition of 1/- per passenger for terminal motor transport.

† Indicates aeroplanes originally constructed for war purposes.

‡ Indicates figures based on disposal prices plus cost of conversion to civil use in case of aircraft.

## TABLE B.—SEAPLANES

	Short Sporting Type,	Supermarine Cross-Channel Type.	F.2A.	Vickers Amphibian.	Fairey Amphibian.	Supermarine Amphibian.
<b>CAPITAL EXPENDITURE</b>						
<b>Six Seaplanes, each flying 1,000 hours per annum.</b>						
1. Number of engines .. .. .. ..	1					
2. Horse-power and make of engines .. .. .. ..	160 h.p. Beardmore	240 h.p. Puma	350 h.p. Rolls	450 h.p. Lion	450 h.p. Lion	350 h.p. Rolls
3. Cost of seaplane .. .. .. ..	£2,500	£2,500	£6,000	£5,500	£2,500	£4,000
4. Cost of engine .. .. .. ..	£500	£350	£3,200	£2,000	£2,000	£1,600
<b>5. COST PER MACHINE</b> .. .. .. ..	£3,000	£2,850	£9,200	£7,500	£4,500	£5,600
6. Total cost of six seaplanes .. .. .. ..	£18,000	£17,100	£55,200	£45,000	£27,000	£33,600
7. Spare engines .. .. .. ..	1,000	700	6,400	4,000	4,000	3,200
8. Stock of seaplane and engine spares (25 per cent. of value of machines) .. .. .. ..	4,500	4,275	13,800	11,250	6,750	8,400
9. Slipways and landing stages .. .. .. ..	4,000	4,000	6,000	4,500	4,000	4,000
9a. Repair sheds (small) .. .. .. ..	5,000	5,000	9,000	5,000	5,000	5,000
9b. Repair sheds (large) .. .. .. ..	12,000	12,000	20,000	12,000	12,000	12,000
10. Motor boats (two) .. .. .. ..	1,800	1,800	1,800	1,800	1,800	1,800
10a. Motor transport vehicles .. .. .. ..	1,000	1,000	1,000	1,000	1,000	1,000
10b. Machinery and plant at terminal stations .. .. .. ..	2,000	2,000	3,000	2,000	2,000	2,000
11. Working capital (two months' running costs) .. .. .. ..	10,500	11,000	24,400	16,700	14,000	14,670
<b>12. TOTAL CAPITAL OUTLAY</b> .. .. .. ..	£59,800	£58,875	£140,600	£102,750	£77,550	£85,670
<b>STATEMENT OF COST</b>						
<b>Of operating Seaplanes each flying 1,000 hours per annum.</b>						
13. Maximum speed .. .. m.p.h.	83	79	95	120	119	100
14. Cruising speed .. .. m.p.h.	71	68	74	100	92	85
15. Number of passengers full load .. ..	3	3	5	4	2	4
16. Cubic capacity for cargo .. .. cubic ft.	—	65	350	—	52	55
17. Full cargo load .. .. lbs.	450	480	950	700	820	950
18. General charges (Tables G and H of Appendix) ..	19,710	28·6	19,710	27·5	22,520	14·1
19. Maintenance—	19,710	28·6	19,710	27·5	22,520	14·1
(a) Labour (see Table E of Appendix) ..	6,680	9·7	6,680	9·3	12,570	7·8
(b) Spares, based on 25 per cent. of value of machines ..	4,500	6·5	4,275	6·0	13,800	8·6
20. Pilots, at £1 per hour, plus retaining fee ..	6,800	9·9	6,800	9·5	6,800	4·2
20a. Pilots, assistant, at 10s. per hour, plus retaining fee ..	—	—	—	3,800	2·4	—
21. Petrol and oil (6,000 hours), petrol charged at 4s. per gallon ..	14,025	20·3	17,500	24·4	54,120	33·8
22. Insurance of seaplanes at 15 per cent. ..	2,700	3·9	2,565	3·6	8,280	5·2
23. Depreciation of machines—	8,500	12·4	8,250	11·5	24,400	15·2
3,000 flying hours, engines .. ..	—	—	—	20,500	18·6	11,500
2,000 flying hours, aeroplanes .. ..	5,980	8·7	5,890	8·2	14,060	8·7
24. Interest on capital, 10 per cent. .. ..	—	—	—	10,275	9·2	7,755
<b>25. SIX MACHINES, 1,000 HOURS EACH</b> .. ..	£68,895	100·0	£71,670	100·0	£160,350	100·0
26. Cost per flying hour, per machine .. ..	£	s.	d.	£	s.	d.
27. Cost per aircraft mile .. ..	11	10	0	11	19	0
28. Cost per passenger mile .. ..	0	3	3	0	3	6½
29. Cost per passenger per journey of 240 miles on 100 per cent. load factor ..	0	1	1	0	1	2
30. Cost per passenger per journey of 240 miles on 75 per cent. load factor .. ..	12	19	0	14	1	0
31. Cost per passenger per journey of 240 miles on 50 per cent. load factor .. ..	19	8	6	21	1	6
32. Cost per ton of cargo per mile .. ..	25	18	0	28	2	0
33. Cost per ton of cargo per journey of 240 miles .. ..	0	16	1½	0	17	0½
34. Cost per lb. of cargo per journey of 240 miles on 100 per cent. load factor .. ..	193	8	0	196	19	0
35. Cost per lb. of cargo per journey of 240 miles on 75 per cent. load factor .. ..	0	1	8½	0	1	9
36. Cost per lb. of cargo per journey of 240 miles on 50 per cent. load factor .. ..	0	2	7½	0	2	7½
37. Cost per cubic foot per journey of 240 miles on 100 per cent. load factor .. ..	0	3	5½	0	3	6
	—	—	—	0	4	11½
				—	—	0
				0	15	4
				—	—	0
				0	16	8

Taking the analogy of the motor-bus, we see that every part is so designed that it can be got at without dismantling other parts, and repairs are therefore carried out expeditiously, the cost of labour is saved, and more important still, the amount of time during which the vehicle has to stand in the repair shed is reduced to a minimum. This has only been arrived at after years of experience, but let us learn the lesson as early as possible.

In the repair of aircraft this factor of ease of repairs is even more essential. The capital locked up in each machine is heavy—every day the machine stands in the repair shops it is capital not earning revenue—and it is therefore of first importance that the time for repair should be minimised to the utmost extent. I would suggest, for instance, that it would be a great advantage if the entire engine unit could be removed from the machine *en bloc*, so that even when a small defect arises it would not be necessary to keep the whole aeroplane standing idle, and the engine unit could be taken out perhaps by the removal of three or four bolts and replaced by another complete engine unit. Another point is that controls of the machine should be capable of easy examination and replacement. If our designers can

produce machines bearing in mind the point of view of accessibility and simplicity, there will be a material reduction in the cost of maintenance. Then with regard to the engine, it is also desirable that the construction should be as simple as possible to enable them to be easily overhauled, and the same accessibility to parts is also desirable.

#### Standardisation

I have already pointed out the importance of standardised containers for postal and goods traffic, and somewhat the same argument for standardisation of other parts of aircraft and engines holds good. As the operation of transport services extends, aircraft will be continually landing in countries other than their own, and much time will be lost, to say nothing of the expense, if whenever slight repairs are required days of delay may be involved whilst waiting for parts that can only be obtained from the country of origin of the aeroplane. For instance, I have had brought to my notice the Amsterdam-Copenhagen service which has recently been linked up with the London-Amsterdam service, Airco 9 machines being employed. The Danish company were actually in urgent need of spare nuts and bolts

TABLE C.

Type of Machines...	Single-Engine Aeroplanes	Twin-Engine Aeroplanes	Multiple-Engine Aeroplanes	Single Engine Seaplanes	Twin-Engine Seaplanes
Personnel (see table below)	7	£	£	£	£
Advertising	3,600	3,600	3,600	3,600	3,600
Rent at terminal aerodrome	5,000	5,000	5,000	5,000	5,000
Transport for maintenance works	1,500	2,500	3,000	—	—
Maintenance and running motor boats	—	—	—	1,000	1,000
Maintenance and running transport	—	—	—	750	750
Insurance of buildings and workmen	100	180	220	100	150
Insurance of pilots (including reserve)	160	320	320	160	320
Depreciation on plant at 10 per cent.	200	300	500	200	300
Depreciation on slipways at 15 per cent.	—	—	—	600	900
Depreciation on buildings at 10 per cent.	—	—	—	1,700	2,900
Office expenditure, stationery, printing, etc.	600	600	600	600	600
Contingencies, salving machines and miscellaneous	2,000	3,000	3,500	2,000	3,000
Administration expenses	4,000	4,000	4,000	4,000	4,000
	18,160	20,500	21,740	19,710	22,520

## Personnel

	£
Chief pilot or traffic manager	600
Navigation controller	500
Business manager and accountant	500
Foreign station manager	500
2 Customs clerks	400
2 typists at terminal seaplane station	300
1 typist at foreign seaplane station	200
2 accounting clerks	450
1 general clerk	150
Total	£3,600

TABLE D.—Maintenance Costs for Labour

Aeroplanes and Seaplanes...	Single-Engine Machines	Twin-Engine Machines	Multiple-Engine Machines
Chief engineer	£ 500	£ 600	£ 700
Staff at London aerodrome	4,680*	9,570†	13,310†
Foreman and mechanics at Paris aerodrome	900§	1,800	3,550¶
Storekeepers (one at each terminal)	600	600	600
Total	6,680	12,570	18,160

\* 1 foreman at £7 per wk.; 10 mechanics at £5 10s. per wk.; 7 labourers at £4 per wk.

† 1 foreman at £8 per wk.; 24 mechanics at £5 10s. per wk.; 11 labourers at £4 per wk.

‡ 1 foreman at £9 per wk.; 34 mechanics at £5 10s. per wk.; 15 labourers at £4 per wk.

§ 3 mechanics. || Foreman and 5 mechanics.

¶ Foreman and 9 mechanics.

for these machines, and as the sizes used in their country did not correspond with ours there were several days' delay while these were being sent for. It is perhaps not altogether a bad thing for us to have the supply of all the spares for our productions, but as against this it is in the interests of the development of aerial transport that aircraft should move about from place to place without being held up for small troubles of this character. It may not yet be possible to carry this matter of standardisation very far, but it is worth consideration, and possibly the beginning might be

made through the International Air Navigation Commission, and a conference on the subject might thrash out the difficulty.

## CHAPTER IX

## Special Requirements and Opportunities for Aircraft in Foreign Countries

So far I have dealt with aeroplanes and seaplanes operating near home, and have devoted the greater part of my paper to discussing the various problems which have to be faced to make European air transport successful. One good reason for so doing is that if the climate we have at home can be mastered, the problems met with in other countries, where the climatic conditions are generally more favourably, will be comparatively easy to deal with.

## Problems of Climate

The fog difficulty is not met with to any extent in other parts of the world; on the other hand, there are other climatic conditions which bring out new difficulties. In the tropical countries we have the difficulty of intense heat, in some cases combined with excessive moisture. The type of aircraft, therefore, which is perfectly suitable for Europe may not be suitable for these other conditions. The material used in construction will need special study; it remains to be seen whether a metal construction either ferrous or non-ferrous will meet this difficulty. Another peculiar feature, for instance, of the African tropics is the loss of lift which affects the aeroplane. In the African flights this was found to be a serious handicap, and it is a point that constructors must bear in mind in machines that have to be used under similar conditions. Then again, the excessive heat materially affects the efficient working of the engines; probably one of our greatest difficulties will be the efficient cooling of the aircraft engine in these tropical climates. It may be that the air-cooled engine is the present possible solution of the difficulty, but that is for the constructors to consider.

If we turn to the climatic conditions to be met with in the cold countries such as Canada and Northern Europe, we meet with excessive cold. While this does not affect the question of life of the aircraft to the same extent, it does create the difficulty of getting off and landing, as the countries are frost bound and snow and ice have to be contended with. Then, again, the engine question has its peculiar difficulties in the cold countries. In these countries the question of starting up and the avoidance of freezing up engine and radiators becomes serious. It follows, therefore, that where the climatic conditions met with are of either extreme the aircraft and engines have to be designed to cope with the special circumstances.

## Speed and Load

Without dwelling at length on the detailed performances which will be called for in machines for foreign countries, it may be pointed out that there is greater latitude as regards speed, and the necessity for it is generally speaking less than in European countries, where the network of railways and the average speed of travelling is higher. For instance, if the cruising speed of an aeroplane in Africa were 80 m.p.h. it would give a sufficiently speedy service, and, as compared with other transport, would still be ample to deal with the lighter winds prevalent in that country. This would allow a heavier useful load to be carried, and if the machine is designed to meet these particular conditions economy in operation may be gained.

## Repairs in Remote Regions

The question of repairs in remote regions is of considerable importance to people who may be commencing air transport services in out-of-the-way places of the world. It either means spending money on plant and machinery which is also difficult to transport, or the construction of aircraft so simplified that repairs may be more readily dealt with than has hitherto been the case. It may be found that aircraft will have to be dealt with more on the lines of unit components. The operator would then stock these components and simply replace the damaged parts by a new spare unit.

This point of view is one which needs to be borne in mind in supplying aircraft for colonial and foreign countries.

## Transport of Aircraft and Spares to Foreign Countries.

The present-day aircraft, although carrying heavy loads, is, from the point of view of handling, a somewhat fragile construction. Take, for instance, a wing which is to be sent from this country to the other side of the world, and handled by a succession of labourers who have not the slightest idea of the article they are handling; any protection, therefore, which can be embodied in the design at the right place to prevent damage will certainly ensure a safer journey, and further, in the hands of the repair staff when the repairs

are being made, there will be less risk of damage before the part is finally placed in the machine. It must be remembered that much of the labour in foreign countries is of the roughest description.

*Probable Need of Spare Parts being Made in the Country of Use*

The difficulty of safely transporting spare parts from this country, together with the high cost for freight, indicates the probable necessity for companies establishing transport companies in colonial or foreign countries being able to make their own spare parts for the aeroplane.

There is no reason why arrangements could not be made by the constructors at home to convey such information to the users as would enable them to satisfactorily make in their own workshops the simpler parts of the aeroplane. Such things as metal fittings and engine parts would no doubt be shipped from this country, but these are not of any bulk and easily transported.

*Great Field for Use in Colonies*

The need and field for the use of aircraft appears to be greater in the Colonies and such countries as South America than at home, and the business of supplying these places with their machines will more surely come to this country if the constructors study the requirements and demands which are made by these other countries.

*Conclusion*

We come therefore to our conclusion:—What is the conclusion of the whole matter—what are the impressions which remain with us after a consideration of some of the essential facts regarding commercial aviation of today?

I must confess that when I started to write this paper my feelings were somewhat pessimistic, certainly for the immediate

future. As, however, I came to consider the figures and the evidence of a very definite improvement in the efficiency and performances of modern civil aircraft, the cloud of pessimism began to clear, and I really believe we today see more light, and there is more hopefulness in the whole position.

I hope that my paper may be the means of showing that while financial success may not yet be achieved, it is not far off, and it is certain enough for business men to give civil aviation their serious attention as the coming means of rapid transit, and if other countries are not to go ahead of us, they must soon be taking an active and personal interest in this important subject.

To my mind the figures we have examined point clearly to the necessity of continued technical progress, and I would like to again urge the need of the Air Ministry giving the constructors of this country every possible support by placing orders with them for new types of experimental machines to enable them to maintain the backbone of efficient designing departments. While the trend of military and civil design will no doubt each year become more divergent, I think it will be generally agreed that progress in civil design is bound to have a most beneficial reaction on the military side. The qualities of reliability, speed, general efficiency, economy and no doubt weight-carrying, all of which are also valuable from a military point of view—will undoubtedly be fostered. Therefore there is a strong case for the Government supporting civilian development.

Finally, I hope that this paper may be helpful not only to those engaged in aerial transport services, but especially to the aircraft and aero engine constructors, to spur them on to cogitate on what can be done to meet the call of the future.

## THE ROYAL AERO CLUB OF THE U.K.

### OFFICIAL NOTICES TO MEMBERS

#### FINANCE COMMITTEE

A MEETING of the Finance Committee was held on Wednesday, September 22, 1920, when there were present:—Mr. J. H. Nicholson, in the Chair, Lieut. Col. F. K. McClean and the Secretary.

#### HOUSE COMMITTEE

A Meeting of the House Committee was held on Monday, October 4, 1920, when there were present:—Mr. Ernest C. Bucknall, in the Chair, Major H. Graeme Anderson, Mr. Herbert J. Corin, Mr. Henry Knox, Lieut.-Col. F. K. McClean and the Secretary.

#### COMMITTEE MEETING

A Meeting of The Committee was held on Wednesday, October 6, 1920, when there were present:—Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S., in the Chair, Major-General Sir Sefton Brancker, K.C.B., Mr. Ernest C. Bucknall, Lieut.-Col. Spenser D. A. Grey, D.S.O., Squadron-Leader T. O'B. Hubbard, M.C., R.A.F., Lieut.-Col. F. K. McClean, Lieut.-Col. Alec Ogilvie, Lieut.-Col. Mervyn O'Gorman, C.B., and the Secretary.

**House Committee.**—The report of the Meeting of the House Committee held on October 4, 1920, was received and adopted.

**Election of Members.**—The following New Members were elected:—

Archibald John Curry.

Norman Gordon Stewart-Dawson.

Archibald James Greenshields.

Flight-Lieut. William Arthur Skeate, R.A.F.

**Life Membership.**—The following were elected Life Members:—

Capt. C. B. Bond.

The Lord Foley.

The following Resolution was unanimously passed:—

“Resolved that from this date the Compounding Fee for Life Membership be Seventy Guineas.”

**Finance Committee.**—The report of the Meeting of the Finance Committee held on September 22, 1920, was received and adopted.

**Air Conference.**—The following were appointed to represent the Club at the Air Conferences to be held at the Guildhall, London, on October 12, 13 and 14, 1920:—

Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S.

Major-Gen. Sir Sefton Brancker, K.C.B.

Air-Commodore E. M. Maitland, C.M.G., D.S.O., R.A.F.

Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P.

Lieut.-Col. Mervyn O'Gorman, C.B.

Mr. Howard T. Wright.

#### Paris-London-Paris Race for Transport Machines.

—The details discussed with the Aero Club de France were reported and the Secretary was instructed to make arrangements at Waddon Aerodrome, Croydon, for the supply of petrol, ballast, etc. The following officials were appointed to represent the Club at Croydon and Paris:—

Croydon—

Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S.

Wing-Commander W. D. Beatty, C.B.E., A.F.C., R.A.F.

Squadron-Leader T. O'B. Hubbard, M.C., R.A.F.

Lieut.-Col. F. K. McClean.

Mr. H. E. Perrin (Secretary).

Mr. B. Stevenson (Assistant Secretary).

Paris—

Lieut.-Col. W. A. Bristow.

Major R. H. Mayo.

**Flying Machines for the Use of Members.**—The Secretary reported the present position in regard to the machines acquired for the use of the Members.

**Gordon Bennett Aviation Cup, 1920.**—The report of the Club Officials who attended the Gordon Bennett Race at Etampes was received and it was decided to vote a sum of Two Hundred Guineas to Mr. F. P. Raynham in recognition of his very sporting effort to win the Cup for Great Britain.

A vote of thanks was passed to Lieut.-Col. F. K. McClean, Lieut.-Col. Mervyn O'Gorman, C.B., Lieut.-Col. W. A. Bristow and Mr. R. J. MacGeagh-Hurst for the assistance rendered by them to the British Competitor at Etampes.

**Aviators' Certificates.**—The following Aviators' Certificates were granted:—

7885. Harold Stunde (Estonian Subject).

7886. Leo Janv (Estonian Subject).

7887. Richard Teiman (Estonian Subject).

7888. Carl Fiscar (Estonian Subject).

7889. Jacob Tillo (Estonian Subject).

7890. Konstantin Kursmann (Estonian Subject).

7891. Paul Paev (Estonian Subject).

7892. Frederick Ellam.

7893. Harold James Ellam.

7894. Jose Cabral (Portuguese Subject).

7895. Archibald James Greenshields.

7896. Marion Hughes Aten.

7897. George Frederick Tetley.

7898. William Pool.

7899. Nikolai Tuimann (Estonian Subject).

7900. Christian Ernest Pitman.

Offices: THE ROYAL AERO CLUB,

3, CLIFFORD STREET, LONDON, W. 1.

H. E. PERRIN, Secretary.



## A RACE FOR AIR SERVICE MACHINES

IN connection with the flying meeting at Buc a race had been arranged for air service machines between Paris, London, and Paris on Sunday last. A similar race was to take place between Paris, Brussels and Paris. Five machines started from Buc for London, and of these three arrived at the London terminus aerodrome at Waddon, near Croydon. The five machines were two Nieuports, one Spad, one Farman Goliath, and one S.E.A. (Henry Potez). The loads carried by the various machines were as follows: Nieuport F.—C.G.A.T., pilot Lasnes, with three passengers, left Buc at 10.36. Nieuport F.—I.C.G.T., pilot Lecointe, with mail, started at 10.45. Spad F.—C.M.A.Y., pilot Bourdon, two passengers, left at 10.57. Farman Goliath, F.—G.E.A.D., with eight passengers, started at 11.42, and S.E.A., pilot Bajac, with three passengers, left Buc at 10.48.

The weather was anything but favourable, the visibility being poor, with a high wind. In spite of this, however, a great number of visitors gathered at the Waddon aerodrome, proving that the public still takes a quite keen interest in flying events. The enclosure set aside for the public was filled to overflowing, and the road leading down to the aerodrome was lined with spectators who had a good view of the landing ground from there. On the aerodrome itself privileged visitors spent the time, while waiting for the arrival of the French machines, inspecting some of the regular London-Paris air service machines lined up in front of the enclosure. The day being Sunday there were few machines starting and arriving. A couple of Airco machines stood facing the breeze in front of the public enclosure, while the Vickers Vimy Commercial owned by the Instone Air Line had her engines tested to the great delight of the onlookers who had the benefit of the slip-stream from the propellers. Just by way of passing the time away the "City of London" made a few passenger flights, during which the pilot gave a fine demonstration of handling this large machine as though she were a small single-seater. A Westland Limousine left for parts unknown, making a fine get-away in spite of the bumpy state of the air.

The Royal Aero Club was represented, in the capacity of official observers, by Lieut.-Col. McClean, Squadron-Leader T. O'B. Hubbard, Lieut. Commander H. E. Perrin, and Mr. Stevenson, the Assistant Secretary of the R.Ae.C., while the French Aero Club was represented by M. Rey.

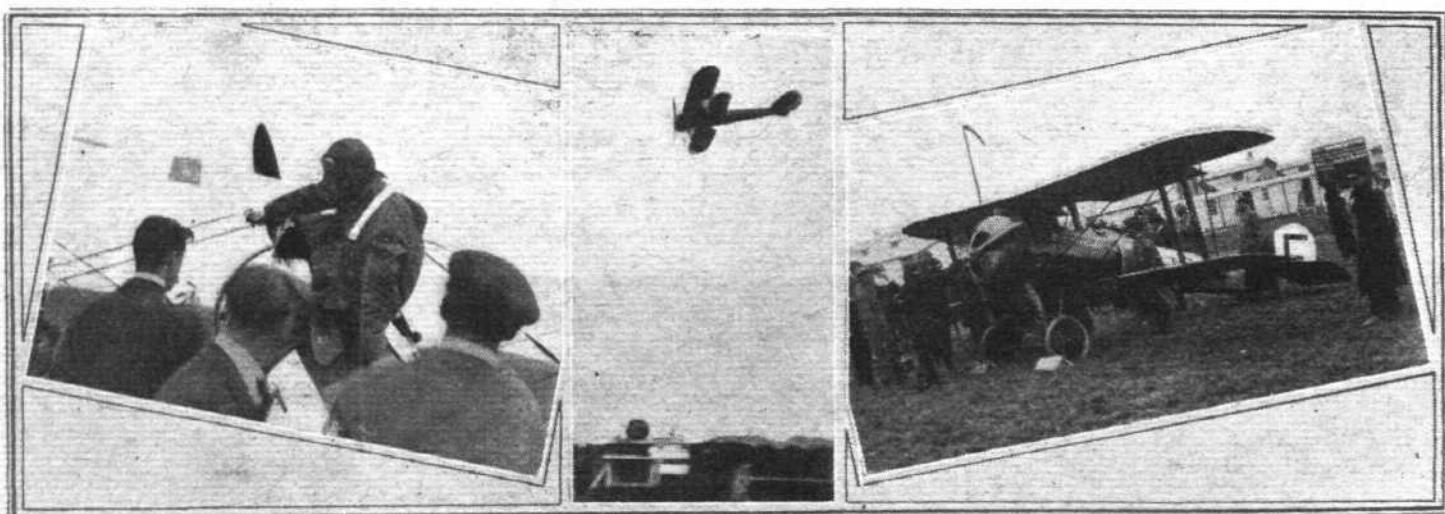
The first machine to arrive was the Spad, piloted by M. Bourdon, who alighted at 1.10 p.m. Coming in just

by the gap in the hedge by the "Level Crossing" of the road leading between the two landing grounds, he appeared to strike a bump and the machine bounced into the air, pancaking down from an altitude of several feet. Fortunately the machine did not turn over, but the landing was not a pretty one.

Taxying up to the enclosures the Spad was brought to a standstill and the two passengers uncurled themselves from the cabin, no doubt heartily glad of the opportunity of getting the kinks out of their legs. No sooner had the Spad landed and its papers been stamped, signed, and sealed than another machine was seen in the haze. This turned out to be the S.E.A. or Henry Potez, piloted by M. Bajac, who was accompanied by three passengers. He made a good landing, apparently, but when the machine came closer it was seen that it was leaning to starboard. It was found that the tyre had burst, and the mechanics soon got busy replacing the wheel. This machine is similar to one exhibited by this firm at the last Paris aero show, with a sort of coupé cabin into which are squeezed, without the aid of a shoe lifter, three passengers.

The Spad got away again at five minutes past two, and the visitors settled down to watch the replacing of the wheels and other minor repairs to the S.E.A. while awaiting the arrival of the Nieuports and the Farman Goliath. According to wireless messages one of the Nieuports had turned back, but the other was reported from Lympne. Of the Goliath there was no news, apparently he had met a David on his way and thought discretion the better part of valour. At last, towards 4 p.m. a small machine appeared. This turned out to be the little Nieuport piloted by Lecointe, who had, apparently, been wandering about in search of Waddon for several hours. He jumped out of his machine and got hold of his mail bag, which an over-zealous helper had already attempted to grab, and, when it had been duly signed for surrendered it to the proper official. Later in the afternoon Lecointe set off for Paris.

Owing to the adverse weather conditions the race was not an unqualified success, but it served to show the popular interest still taken in flying, and makes one wonder whether some similar events could not be arranged in this country. A series of relay races with air mail might be both amusing and instructive, and would at any rate help to give the "man in the street" an idea of what is being done in the way of air mail and passenger services.



PARIS-LONDON-PARIS RACE : Centre, the Nieuport, piloted by Lecointe, arrives over Waddon aerodrome. On the left, M. Lecointe getting out of his machine, and on the right, the Nieuport biplane at rest

## THE BUC MEETING



PARIS-LONDON-PARIS RACE : The Henry Potez machine has its wheels replaced. On the right, M. Bajac, the Potez pilot, and two of his passengers enjoying their sandwiches

THE above race was one of the items at the three days' gala at Buc last weekend, at which some very fine flying was seen, and the meeting should give a welcome fillip to aviation in France. It was graced by the presence of the newly-elected President, M. Millerand, and a whole bevy of Ministers, including M. Flandin, the Under-Secretary for Aeronautics, while Great Britain was represented by, among others, Major-General Sir Frederick Sykes, Controller-General of Civil Aviation, and Brig-General Festing, who arrived by the airway.

The actual flying opened on the 8th with a practical demonstration of flying, a cross-country cruise for "owner-drivers." Those who took part were Maurice Farman on a Maurice Farman, René Caudron on a Caudron, Breguet on a Breguet, Robert Morane on a Morane, André Dubonnet on a Spad, Marcon on a Caudron, Chemin Douce (Blériot), Mdlle. Bolland (Caudron), Sadi Lecointe (Nieuport), Fonck (Spad), Douchy (Potez), and Papin (Farman), and all of them completed the course Buc-Chateaufort-Toussus-Villacoublay-Buc without incident. This was followed by an event in which the competitors had to rise to a height of 2,000 metres and land. The best time was made by Thierry on a Breguet-Rateau, 7 m. 50 $\frac{1}{2}$  secs., Maneyrol and Fronval on Moranes,

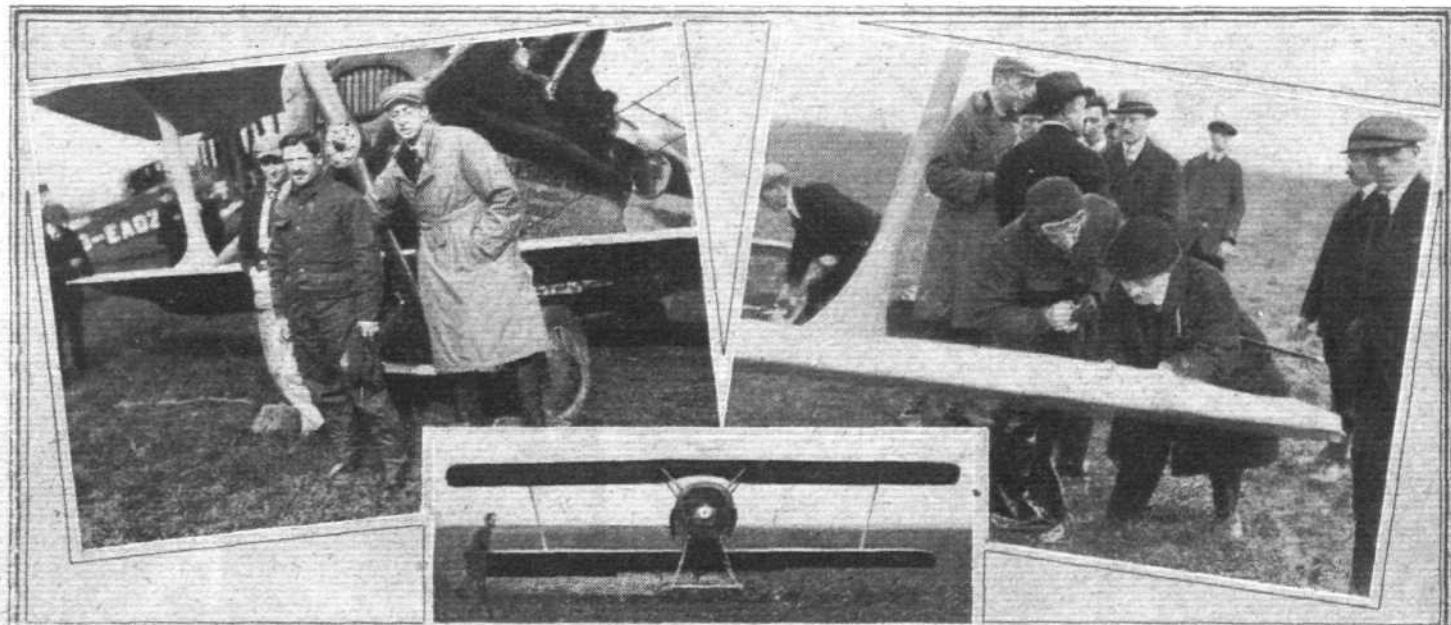
tying for second place in 9 mins. 10 secs., with Bouyer on a Hanriot next in 10 mins. 33 secs.

During the reception of the President, a Farman Goliath cruised over the aerodrome, a passenger, M. Chrétien, took photographs, developed them on board, and presented a finished print to M. Millerand, immediately the machine landed. Kirsch and Moutonnier, on Nieuports, went for altitude tests, but were content with 4,000 metres and 3,500 metres respectively. Roget with his wife and the famous dog, did a demonstration flight on the circuit-of-Europe-Breguet and Morane also took a passenger for a flight.

During the afternoon three dirigibles—two Zodiacs and an Astra-Torres—cruised over the ground.

On the following day the outstanding item was the speed trials over 1 kilom. flown in opposite directions in accordance with F.A.I. rules. Here Bernard de Romanet (Spad) was classed first with 292.682 kiloms. per hour, Sadi Lecointe (Nieuport) being second with 288 k.p.h., and Casale (Spad) third with 257.142 k.p.h. Later Lecointe did 293.877 k.p.h., but as there was not a clear 4 k.p.h. in advance of Romanet's figure, it could not be accepted for record. The previous record was Casale's 283.234 k.p.h.

In the *concours d'adresse* in which the competitors had to



PARIS-LONDON-PARIS RACE : Centre, the Spad, piloted by Bourdon, just landed at Waddon aerodrome. On right, M. Bourdon has his papers signed by M. Rey, the French official, at Croydon. In this picture are Commander H. E. Perrin and Squadron-Leader T. O'B. Hubbard. On the left, M. Bourdon and his two passengers



Paris-London-Paris Race : Two of the R.A.C. officials at Waddon. On the right, Squadron Leader T. O'B. Hubbard ; and on the left, Mr. Stevenson, with the official seals

burst toy balloons, Thierry on a Breguet, was placed first, followed by Pelletier d'Oisy (Morane), Pillon (Farman) and Bouyer (Hanriot), each of whom also "bagged" two each. The altitude competition brought out Roget and Thierry on Breguets and Kirsch on a Nieuport, and they reached 5,000, 7,500 and 6,500 metres respectively.

Demonstrations of parachute descents, tactical flying by a party of military pilots, passenger flights and dirigible cruises, etc., also formed part of the day's work, while the miniature bi-planes of Pischoff, Caudron, and Potez gave exhibition flights.

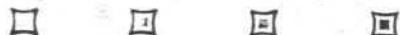
On the last day there were the races

to Brussels and back and to London and back for transport machines. The former section was won by Deullin on a Potez S.E.A. in 4 hrs. 15 mins. 12 secs., with Lemen on a Breguet second, and d'Or on a Farman Goliath, third. In the London section Bourdon on a Spad was first in 4 hrs. 46 mins. 16 secs., with Bajac on a Potez second.

Lecointe (Nieuport-Hispano) made a successful attempt on the speed record of de Romanet by attaining 296.694 k.p.h. In the height competition Roget, Thierry and Kirsch were each credited with 7,000 metres, and in the speed handicap Thierry was placed first with Frouval second. Fronval on his Morane won the landing competition, getting within 2.6 metres of the mark, the next best being Douchy on a Potez, 34 metres out. Other incidents of the day were a bombardment of Buc fort by an escadrille of Breguets escorted by an escadrille of Moranes from the Metz centre, and an exhibition by Casale on the 4-engined Blériot.



Paris-London-Paris Race : M. Rey, the French official, at Waddon.



## AERONAUTICS AT THE SCIENCE MUSEUM, SOUTH KENSINGTON

THE Collection of Aeronautics in the Science Museum has been recently rearranged, and now occupies one of the galleries of the new Science Museum Buildings in Exhibition Road. Many important additions have been made to it, so that visitors can study the development of aeronautics from early times in the many objects of great historical interest, while the progress made in aviation during the last six years is represented by numerous exhibits which have been recently acquired.

The collection is arranged in six sections—airplanes and airplane models, airplane construction, engines, instruments, experimental apparatus, and ballooning.

In the first of these an object of special historical interest is the Henson flying-machine model of 1842-5, which bears a striking resemblance to the modern monoplane, but was doomed to failure chiefly on account of the lack of a light engine of high power. Early pioneer work in gliding is illustrated by Lilienthal's glider, similar to the one on which he met his death in 1896.

The development of the modern airplane can be followed in the series of scale models by which the machines of the Brothers Wright, Voison, Farman, Blériot, Santos-Dumont, and the German Taube are represented. Among the full-



### Gift of Aeroplanes to India

OF the 100 aeroplanes which have been presented to India by the Imperial Government, a certain number have been given to local governments, others are to be presented to ruling princes, and 20 will be retained for the Air Force in India. It is proposed to offer the remainder to aero clubs, ex-R.A.F. officers resident in India, or to companies prepared to establish aviation schools. The machines will be handed over free of charge at Karachi, on condition that they are used for purposes of demonstration and instruction, and are not sold to third parties.

### Flying Without the "Joy Stick"

By way of demonstrating the possibility of flying an airplane simply by controlling the engine and using the rudder, Fronval recently made a flight on a 80 h.p. Morane-Saulnier monoplane with the "joy stick" tied up and sealed so that it was impossible to use it. In the presence of officials of the Aero Club of France the machine rose from the ground, circled several times round the Villacoublay aerodrome and then made a perfect landing.

size machines are the only existing machine of Cody, and the Vickers-Vimy Rolls-Royce aeroplane which crossed the Atlantic last year.

In the section devoted to aeroplane construction are examples of historical and modern propellers, and actual portions of early and modern aeroplanes, in which the methods of construction may be compared. Portions of an early Wright biplane have been preserved, and the visitor can operate and study the control mechanism of this machine.

The collection of aeroplane engines ranges from the early steam-engines of Henson and Maxim to the modern high-power petrol-engine, and the collection of engines of types used during the War, including British, French, Italian, as well as German models, is of great interest.

A wind-channel and a water-channel for experimental work may be seen in operation ; the principal instruments used in aerial navigation and reconnaissance are also shown.

Balloons and airships are not as yet so fully represented, but to all sections additions are continually being made, and it is to be hoped that eventually a collection of scale models of airships will be arranged for, so that the development of this type of aircraft can be studied.



### An Air Conference at Versailles

AIR questions which have not yet been settled by the Peace Treaty will be dealt with at Versailles during the next few days by a Commission of 28 Allied officers.

### Italian Small-Aeroplane Contest Postponed

IN view of the political situation in Italy preventing the entrants from having their machines ready in time, it has been decided to postpone the international competition for the Mapelli Cup until November 4. This cup has been offered by Mr. Luigi Mapelli for an annual competition for aircraft "having a wing-spread of not more than 6 metres over all, and driven by engines of total stroke-volume up to 4,585 c.mil. inclusive." The competition is a speed one, and each succeeding race is to be for twice the distance of the preceding one. For this year the course selected is Taliedo-Arcore-Ponte S. Pietro-Erba-Malpensa-Cameri-Sesto S. Giovanni-Taliedo, a distance of 182 kiloms. At each of the places named the competitors will have to come down for three minutes, and the machine which completes the course in the shortest time will win the cup.

AIRBMS  
FROM THE  
FOUR WINDS

THUS the *Morning Post*: " Flying today has only one disadvantage—it is that you must return to earth again." Are we to understand that that is really a disadvantage ?

THE Paris correspondent of the *Thunderer* has been indulging in a little trick of renaming some of the well-known French machines. Writing of the sealed " joy-stick " experiment he described the aeroplane as a McRane-Saulnier, which suggests that M. Saulnier has gone to France's old ally for a new partner.

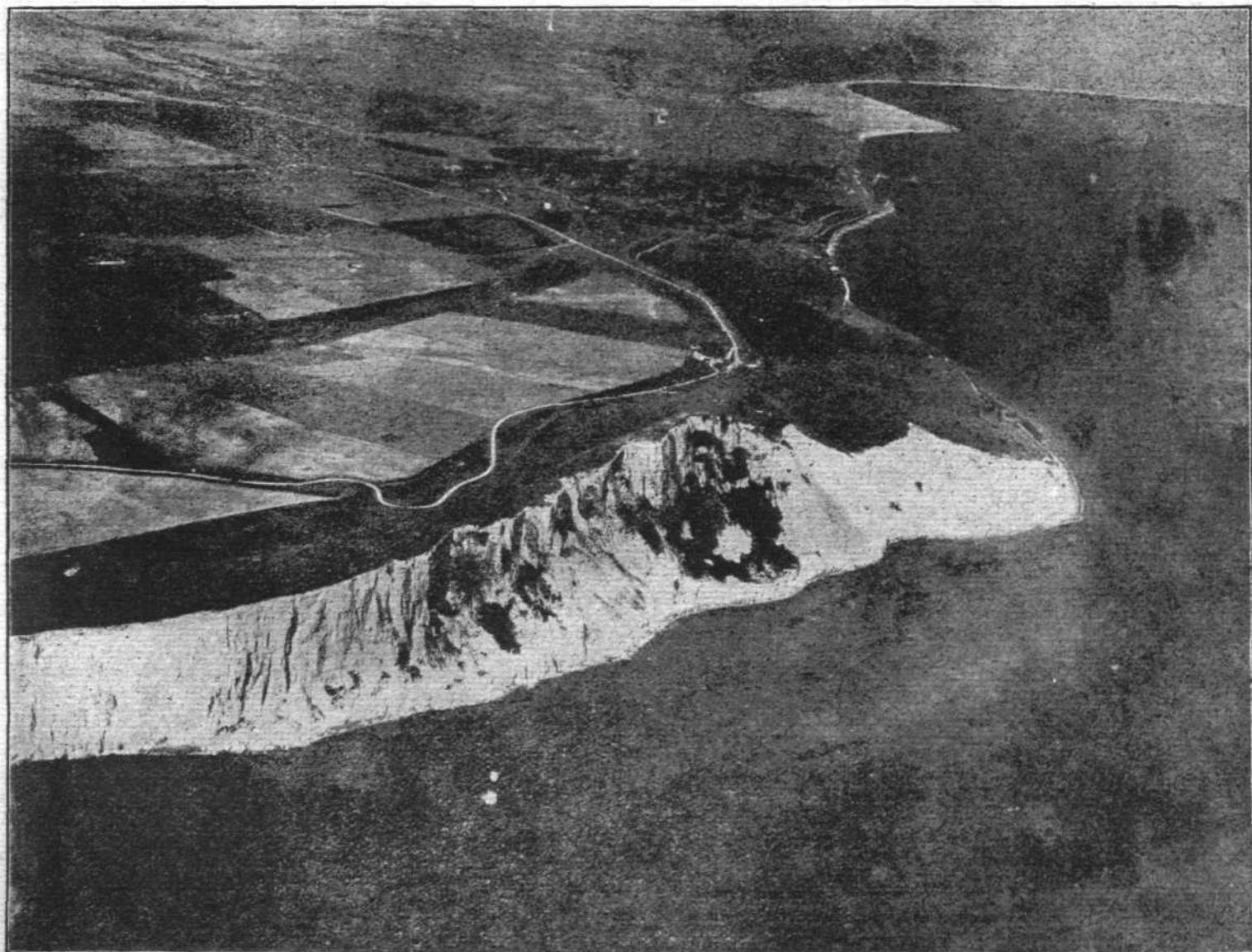
THEN at the Buc meeting, the same writer discovered " three 'aeroplanettes,' the Pischoff, the dual control Potey 8, and the minute Caufron. They were piloted by Mlle. Bolland, who recently attempted to fly across the Channel." From which we gather incidentally that the charming aviatrix had a busy time.

THE same correspondent is also a little weak on speeds, as, in recording the kilom. trials at Buc, he explains: " De Romanet's achievement excels that of Casale, who on a previous occasion reached 283,234 kilometres an hour. Sadi Lecointe later in the day flew even faster than Romanet, attaining 293,877 kilometres an hour on his Nieuport-Hispano,

but in accordance with the international competition regulations he does not hold the official title of fastest flyer, since his speed did not exceed that of de Romanet by four kilometres—the margin considered necessary in order to guard against a possible chronological error." Some speed !

PRODIGIOUS indeed were the camouflage arrangements in contemplation to protect against attack and espionage by aeroplane when the Armistice was signed. Not only were the Germans pastmasters in the art, but both ourselves and the French were getting pretty proficient in deceptive creations. Thus one big scheme is now disclosed, which was contemplated for the mitigation of the bombing of Paris by aircraft. The idea was to construct a " dummy " Paris north of the capital. The plans for this project were worked out by M. Jacopozzi, an engineer, and under these, railway lines, factories of woodwork and canvas, electric light, all would have been built to represent St. Denis, the northern suburb. Paris itself would have been reproduced near the Forest of St. Germain. The intermittent glow from steel foundries was to be imitated by stage devices.

When aeroplanes approached, the real Paris would have remained in darkness and an artificial mist would have risen above the Seine. At the false Paris the alarm would have



Beachy Head and Eastbourne, as seen from an Avro seaplane

been sounded and lighting gradually reduced, though maintained brilliantly enough to form a good mark for hostile aeroplanes. When bombs dropped artificial fires would have been produced to encourage the airmen in their belief that they had just hit their objective.

All of which sounds very wonderful—on paper. Somehow we fancy even such very simple folks as the Germans proved themselves to be in the art of war would have, in time, discovered the artifice. But there's no harm in elaborating the fanciful picture of what might have been.

*Per contra* there appears to be strong corroborative evidence from a German source of the sound theory of German camouflage on an extensive scale which was some little time ago put forward by Mr. Solomon J. Solomon in his "Strategic Camouflage," and referred to in detail in these pages. In support of Mr. Solomon's theories, a review published last month of his book in "Das Technische Blatt" is now quoted. The reference to Mr. Solomon's contentions is as follows:—

"Camouflage is the blue mist which one creates against the enemy's air interpretation, in order that the photographs may be silent about important plans, and that the adversary in other places may be deceived by appearance."

"This is probably the first book in which this actually decisive weapon is depicted, perhaps somewhat too broadly in detail, and penetrated by means of convincing pictures. It confines itself to strategical camouflage; that is to say, the disguising of camps, attack roads, railways, and long-



*Lectures.*—The next meeting will take place at the Royal Society of Arts, John Street, Adelphi, on Thursday afternoon, October 21, when Major-Gen. Sir W. S. Brancker, K.C.B., will take the Chair at 5.30 p.m. On this occasion, abstracts of two papers will be read, to be followed by a discussion. Squadron Leader R. M. Hill will read his paper on "A Comparison of the Flying Qualities of Single and Twin-Engined Aeroplanes," which was presented to the Aeronautical Research Committee, who requested the Royal Aeronautical Society to provide facilities for its wider dissemination and discussion. The second paper will also be of particular interest to Members interested in Aerial Transport, being on "Night Flying" by Mr. Cecil Baker.

*Annual Dinner.*—Owing to the difficulty of finding accommodation, it has been found necessary to postpone the Annual

## CAMBRIDGE UNIVERSITY

THE First Session of the Society successfully terminated in March last with some 130 undergraduate and 20 honorary members on its roll. No lectures have been given during the summer months but in May over 80 members visited the Royal Airship Works, Cardington, Bedford, and some considerable number were to be found at Martlesham during the competitions.

H.R.H. the Duke of York has graciously consented to become the Patron of the Society. As His Royal Highness, besides being a pilot, has also been up at Cambridge the Society feels itself greatly honoured to have as a Patron a member of the Royal family who is so intimately connected with its activities.

The following is the syllabus for the present term:—

Oct. 20. Brig.-General R. K. Bagnall-Wild, C.M.G., C.B.E., "Inspection of Aircraft Steels."

## Zeppelins for Transatlantic Work

It appears from a report emanating from Berlin that representatives of the Inter-Allied Disarmament Committee went to Staaken on the afternoon of October 7 to take over from the Zeppelin Company the new giant airship, specially constructed for a service between America and Germany. The Zeppelin Company refused to surrender the airship on the grounds that Germany is allowed to retain all aircraft built six months after the signing of the Peace Treaty.

Another report has it that the Zeppelin Company has requested permission of the Inter-Allied Air Commission to construct two giant airships for use in international trade between the U.S. and Germany, and that the request was temporarily refused.

## A Record Parachute Drop

A CLAIM for a record is made on behalf of Lieut. A. G.

range cannons, in the assembling places a few kilometres behind the battle-zone. It is incomparably more vital than tactical camouflage, which affects only the protection of direct arrangements, such as trenches, light artillery; and because it hid not only the masses of troops and transport, but above all the designs of the leaders.

"Ludendorff in his war memoirs, under the title of 'The Attack in the West, 1918,' explains to us what this may mean. The author rightly states that the Allies were superior to the Germans in tactical camouflage, but in strategical camouflage we put them in the shade. From March, 1918, when first he perceived the colossal extent of our masking, he conducted a fruitless campaign against the authorities, who declared the whole thing nonsense and unthinkable. Thus, right until the end, the German attacks, nay, even 'Bertha,' which bombarded Paris, remained undiscovered and unhindered.

"And really the scales do fall from the eyes of the civilian when he reads with what simple means the enemy's air-interpretation was fooled for years. Only in this manner was the success which almost invariably attended our mass attacks made possible.

"Space, unfortunately, fails us, if only to point out the penetrating conclusions which the author arrives at, because naturally he is concerned not with their arrangements, but with the German, which he never saw close by, and that for the reason that they were the very first things which we destroyed on our retreat. We agree with him that in future wars on land camouflage will play a large part."



## ROYAL AERONAUTICAL SOCIETY NOTICES

Dinner until November. A definite announcement as to date and place will be made shortly.

*Forthcoming Arrangements.*—It is hoped shortly to be able to announce an addition to the lecture programme in the shape of a paper describing certain experiments which have been carried out in the direction of producing a practical direct lift heavier-than-air machine. This is a matter which has in the past been the subject of many papers read before the Society, and it is hoped that the paper and discussion will result in the dissemination of the latest information in this particular line of research.

*Library.*—The following books have been received and placed in the Library: "The Struggle in the Air, 1914-1918," Charles C. Turner; "Design of Aeroplane Engines," John Wallace; "English-French Aero Dictionary," Leonard Henslowe.

W. LOCKWOOD MARSH, Secretary



## AERONAUTICAL SOCIETY

Oct. 27. Mr. J. D. North, F.A.E.S., F.R.Met.Soc. "The Structural Design of Aeroplanes."

Nov. 3. G. Glauert, Esq., B.A., F.A.E.S. "Spins."

Nov. 10. Public Meeting with Air League of the British Empire, Maj.-Gen. Rt. Hon. J. E. B. Seely, C.M.G., D.S.O., M.P. "Air Supremacy."

Nov. 17. Major J. Erskine Murray, D.Sc. "Communication with Aircraft."

Nov. 24. Mr. C. I. R. Campbell, O.B.E., M.I.N.A., A.F.A.E.S. "Rigid Airships."

Dec. 1. Capt. F. S. Barnwell, C.B.E., A.F.C., F.A.E.S. "Aeroplane Design, some Present and Future Possibilities." Visit to H.M. Airship Station, Pulham. (Date to be announced.)

All Meetings commence at 8.30 p.m.

O. E. SIMMONDS, Hon. Sec.,  
Magdalene College, Cambridge.



Hamilton, of the U.S. Army Air Service, who on September 26 is said to have dropped 20,900 ft. in 12 min. by parachute. The performance was made at Arcadia, Florida.

## Testing a Fireproof Machine

TYPICALLY American in conception was a "stunt" carried out at Mineola on the night of October 6. Mr. Paul Collins ascended in a Curtiss machine which had been treated with a fireproof substance and then saturated with petrol, the pilot's clothes being similarly treated. At a height of 5,000 ft. the machine was set alight and the descent commenced. At a height of 3,000 ft. two magnesium flare on the wing tips were ignited and assisted by the light from these the pilot made an excellent landing. It is stated that both the fireproofing and the system of magnesium flares are the inventions of Mr. W. Parke Bradley, a chemist.

## CORRESPONDENCE

*The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns*

### THE CRASH AT HAYES

[2030] Just when aviation began to show some prospect of rising to its rightful position, it received a nasty set-back by the fatal crash at Northolt. It is not hard to imagine someone saying, "There you are, I told you so; flying never was and never will be really safe." Which is not only a very one-sided view, but quite untrue: for flying is as safe as any other mode of transport, and a good deal safer than some. The accident occurred on a Saturday, which in itself was unfortunate, Sunday being always a bad day for the papers as far as news is concerned, and consequently they seized on this item with glee, and startled the public with accounts of the crash, true and untrue, but all lurid in their detail. They patched and supplied morbid comments, and altogether dwelt on the rather depressing result to such an extent that by the time the man in the street sat down to his mid-day meal, flying had become a hobby of suicidal maniacs. If these same papers would only publish a bit more about the hundreds of passengers who are conveyed weekly to various destinations, and the many tons of mail and goods which are carried overseas by these air lines during the course of the week, the man in the street might realise that flying was, after all, a safe and workable proposition. Instead of this, the papers only awake on the event of a fatal accident, and never a word about the good done whilst they are asleep—which perhaps, has its advantages, although it does not tend to increase the idea of the safety of aviation in the mind of the average man.

On looking through the columns of a paper which gave an account of the crash, the following deaths were also found, under small headings: Two people with throats cut; man fell from train and reduced to produce; boy accidentally shot; decapitated body of man found on the railway line; two men drowned; four bodies washed up on the coast; girl strangled in bed; someone else murdered; man found in yard, apparently having fallen some distance—almost worse than produce; not to mention an odd suicide or two, a number of people run down by cars or 'buses, and the

daily roll from Ireland. Yet, when there is a fatal crash, the outcry is tremendous, and several columns and much ink is wasted, just because flying is a comparatively new mode of travel, and the facts which surround it can be worked up to satisfy a morbid and sanguinary detail-loving public.

The chief point, however, is the cause of the accident. The report at the inquest was quite non-committal. One hears private reports, but the general public knows nothing, beyond the fact that everyone was killed, and the only natural deduction for the unenlightened is that accidents like that often happen and are unavoidable; and the effect wrought on the aircraft firms and aviation in general is most destructive.

Before the War the Royal Aero Club, in the event of a crash, issued a very full report as to the cause or causes. This was of the utmost value to both pilot and constructor. At the present time it is the job of the Air Ministry Accidents Investigation Committee to examine the wreckage and glean such facts as they can from eye-witnesses; but their report may not, by Act of Parliament, be made public, and therein lies the snag. It is absolutely essential that all publicity be given to such a report. Not only will this greatly assist the air companies themselves, and blame be prevented from falling on innocent shoulders, but it will also give the public the assurance that everything is being done to safeguard their interests, and in the light of such exposures as are made, a similar accident will not occur again. If the public does not understand, no matter what, or if they feel that facts are being withheld from them, they will not trust themselves to those who deal with the unknown quantity, and in the case of flying, particularly, they will stand at a distance, fearful and sceptical in the extreme. Only by being told all the facts of the case, and the why and wherefore of every doubtful point, will the somewhat broken *morale* of the man in the street be restored.

C. CLARKSON

### Home from Rumania

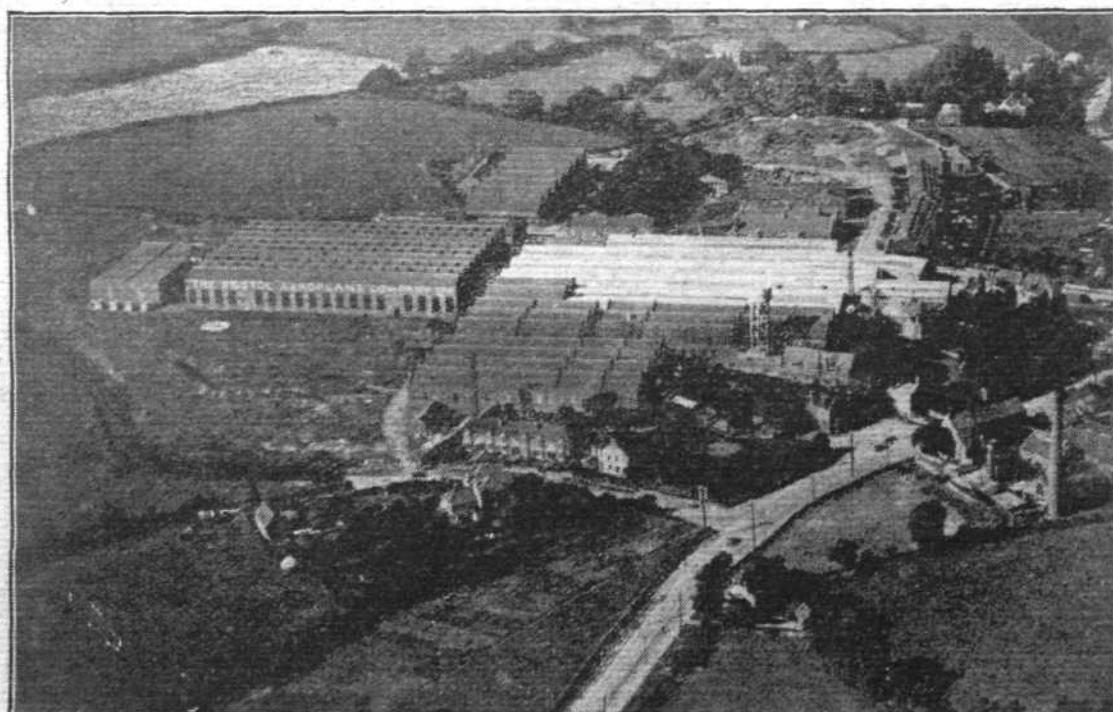
MR. REGINALD WRIGHT, who recently flew to Rumania, arrived at Cricklewood Aerodrome on October 11. The last stage of the return journey was a non-stop flight of 420 miles from Strasburg to London, accomplished in 3 hours 50 minutes, and the average flying speed for the whole journey from Jassy to Cricklewood was just over 100 miles per hour. The machine used was a De H 9 with Siddeley Puma engine and apart from the round trip of 3,250 miles, it was also used for travelling about Rumania. Mr. Wright was thus able to visit Jassy, 215 miles away, and return to

Bukarest in the day, whereas in the present state of the Rumanian railways the journey by rail would have taken 20 hours each way.

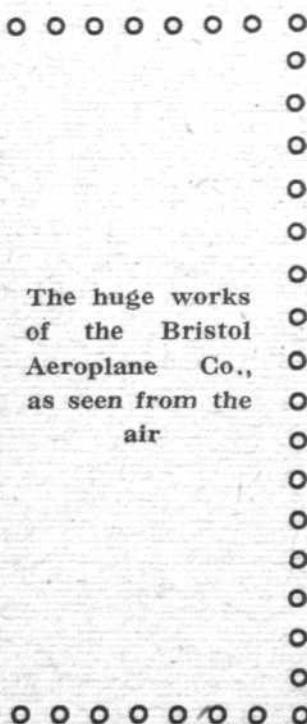
The machine left Bukarest on October 9, spent the night in Vienna, continued on the following day to Strasburg, 415 miles. The flying time for the journey of 1,635 miles from Jassy to London was 16 hrs. 5 min.

### The Scandinavian Air Route

TRAFFIC on the new regular aerial route, Sweden-Denmark-Germany-Holland-England, will be temporarily discontinued during the winter months.



The huge works  
of the Bristol  
Aeroplane Co.,  
as seen from the  
air



THE LONDON-CONTINENTAL SERVICES  
 FLIGHTS BETWEEN OCTOBER 3 AND OCTOBER 9, INCLUSIVE

Route	No. of flights*	No. of passengers	No. of flights carrying		No. of journeys completed†	Average flying time	Fastest time made by	Type and No. (in brackets) of Machines Flying
			Mails	Goods				
Croydon-Paris ...	30	41	9	21	30	h. m. 3 1	Westland G-EAJL (1h. 39m.)	A.9 (4), A.16 (2), A.18 (2), B. (3), Bt. (1), G. (1), N. (2), Sp. (1), W. (2).
Paris-Croydon ...	33	57	6	17	32	1 56	Airco 9 G-EAQ (1h. 32m.)	A.9 (4), A.16 (3), A.18 (2), B. (2), Bt. (1), G. (1), N. (2), Sp. (1), W. (2).
Cricklewood-Paris ...	7	28	—	3	7	4 1	Airco 4 G-EAVL (2h. 55m.)	A.4 (1), H.P. (5).
Paris-Cricklewood ...	7	24	—	4	7	2 19	Airco 4 G-EAVL (2h. 5m.)...	A.4 (1), H.P. (6).
Croydon-Amsterdam ...	8	6	1	7	7	2 48	Airco 9 G-EAQ (2h. 25m.)	A.9 (3), A.16 (2), F. (1).
Amsterdam-Croydon ...	7	3	5	3	7	2 53	Airco 16 G-EAPT (2h. 30m.)	A.9 (4), A.16 (2).
Cricklewood-Amsterdam ...	6	1	4	4	6	2 23	Airco 9 G-EAUC (2h. 10m.)	A.4 (1), A.9 (2).
Amsterdam-Cricklewood ...	6	—	2	2	6	2 54	Airco 9 G-EAUP (2h. 9m.)...	A.4 (1), A.9 (2).
Croydon-Brussels ...	—	—	—	—	—	—	—	—
Brussels-Croydon ...	—	—	—	—	—	—	—	—
Cricklewood-Brussels ...	7	4	5	5	5	2 51	Airco 9 G-EATA (2h. 25m.)	A.4 (4), A.9 (2), G. (1).
Brussels-Cricklewood ...	8	7	4	2	8	2 13	Airco 9 G-EAUN (1h. 40m.)	A.4 (3), A.9 (3), G. (1).
Totals for week ...	119	171	36	68	109			

\* Not including "private" flights.

† Including certain journeys when stops were made *en route*.

A.4 = Airco 4. A.9 = Airco 9 (etc.).

B = Breguet. Bt = B.A.T. F = Fokker. G = Goliath Farman.

H.P. = Handley Page. N = Nieuport. Sa = Salmson. Sp = Spad.

V = Vickers Vimy. W = Westland.

The following is a list of firms running services between London and Paris, Brussels, etc., etc. — Air Post of Banks; Air Transport and Travel; Co. des Grandes Expresses Aériennes; Handley Page Transport, Ltd.; Instone Air Line; Koninklijke Luchtvaart Maatschappij; Messageries Aériennes; Syndicat National pour l'Étude des Transports Aériens; Co. Transaérienne.



### No. 3 Squadron Reunion

THE reunion dinner of No. 3 Squadron is being held tomorrow (Friday) at Gatti's, Adelaide Street, W.C., at 7.45 p.m. It is hoped that all officers and ex-officers will do their best to be present. Tickets (2s 10s. each) may be obtained from Flight-Lieut. J. K. Summers, Royal Air Force Club, Bruton Street, W. 1.

### Crystal Palace R.N. Dépôt Reunion

THE second annual reunion of R.N.V.R., R.N.D. and R.N.A.S. men who passed through the Crystal Palace during the War will be held in London on November 13. Those interested should communicate at once with Mr. E. B. Holmes, hon. secretary, Reunion Committee, 60, Fountayne Road, N. 16.

### Mullion Old Boys

IN view of the third reunion dinner of the Mullion Old Boys' Association, which is to be held in November, all R.N.A.S. Mullion "Old Boys" are requested to communicate with Mr. William G. Lavender, 16, Alma Road, Wandsworth, S.W. 18, so that their present addresses may be correctly registered.

### R.A.F. and Kenley Common

THERE have been recent negotiations between the Air Ministry and the City Corporation concerning the retention for military purposes of the portion of Kenley Common taken by the military authorities in June, 1917, under the Defence of the Realm Regulations.

The Corporation make the following conditions of their assenting to the scheme: (1) That the Air Ministry shall obtain the necessary legislative power to have the land thus alienated and transfer to the Corporation an equivalent area on the east side of the common; (2) that if and when the land is no longer required for use by the Royal Air Force it be re-transferred to the Corporation; (3) that no buildings be erected on the common land and no portion used for civil aviation; and (4) that the Air Ministry bears the entire cost of adapting the new area for use as an open space.

### "Limit Gauging"

THE Thomas Hawkley lecture of the Institution of Mechanical Engineers will this year be given by Sir Richard T. Glazebrook, K.C.B., Sc.D., F.R.S., on November 5, at 6 p.m., at the Institution. He will take as his subject "Limit Gauging."

### Rescued from the Sea

ON her arrival at Hull on October 8, the trawler *Sea Searcher* landed Lieut. McNal, Lieut. Fairweather and another young officer who, while making a trial trip in a large Army aeroplane from their base in the north of Scotland, had

fallen into St. John's Channel, Pentland Firth, on the morning of October 6. Some 20 minutes after passing over the coast engine trouble developed, and the machine alighted on the sea. Foggy weather prevailed. The trawler hove in sight not more than a hundred yards away, but the aeroplane sank before the trawler reached the spot, and the aviators were picked up out of the water. One officer was badly marked about the face.

### Records Homologated

THE Commission Sportive Aéronautique, at its meeting on October 5, decided to accord recognition to the following records made during the Gordon-Bennett race: — Speed over 100 kiloms.: De Romanet (Spad), 23 min. 16 $\frac{1}{2}$  sec.; Kirsch (Nieuport), 22 min. 18 sec.; Sadi Lecointe (Nieuport), 21 min. 28 sec. Speed over 200 kiloms.: Kirsch (Nieuport), 48 min. 52 $\frac{1}{2}$  sec.; De Romanet (Spad), 46 min. 7 sec.; Sadi Lecointe (Nieuport), 43 min. 42 $\frac{1}{2}$  sec.

### Air Work in Mesopotamia

THE War Office communiqué of October 7 stated:

"On the Middle Euphrates aeroplanes reconnoitring over Kufa reported 'All well' signals from the garrisons. Bands of Arabs were observed destroying the Kufa-Nejef line."

"It appeared that the defence vessel 'Firefly' lying alongside the camp at Kufa, has been burnt."

The communiqué of October 8 stated:

"Reconnoitring aeroplanes report no large hostile forces between Khidr and Samawa; small parties of mounted rebels scattered on being fired at by our machines."

"The forces which attacked our column near Nahmudie (20 miles south-east of Baghdad) on the 4th, were bombed and machine-gunned on the 5th by our aeroplanes."

### New Uses for Rubber Wanted

CONSIDERABLE attention has been directed to the prizes, amounting to £5,000, offered by the Rubber Growers' Association for ideas and suggestions for extending the present uses or encouraging new uses for rubber. As the competition does not close until December 31, there is still plenty of time for inventive minds to tackle the problem, and the full conditions under which the prizes are offered may be obtained from the Rubber Growers' Association, 38, Eastcheap, London, E.C. 2.

### Royal Patronage for Motor Exhibition

HIS MAJESTY THE KING has again consented to give his Patronage to the Motor Exhibition organised by the Society of Motor Manufacturers and Traders, Ltd. On this occasion the Exhibition is to be held at Olympia and White City concurrently from November 5 to 13.

**IMPORTS AND EXPORTS, 1919-1920**

AEROPLANES, airships, balloons and parts thereof (not shown separately before 1910). For 1910 and 1911 figures see "FLIGHT" for January 25, 1912; for 1912 and 1913, see "FLIGHT" for January 17, 1914; for 1914, see "FLIGHT" for January 15, 1915; for 1915, see "FLIGHT" for January 13, 1916; for 1916, see "FLIGHT" for January 11, 1917; for 1917, see "FLIGHT" for January 24, 1918; for 1918, see "FLIGHT" for January 16, 1919; and for 1919, see "FLIGHT" for January 22, 1920.

	Imports.		Exports. Re-Exportation.			
	1919.	1920.	1919.	1920.	1919.	1920.
	£	£	£	£	£	£
January ...	555,989	2,323	57,571	32,752	—	697
February	453,822	9,320	57,972	68,932	—	—
March ...	704,424	2,092	72,716	67,600	400	—
April ...	97,662	5,918	25,433	148,484	—	—
May ...	136,631	761,425	38,428	237,627	—	400
June ...	1,410	491	41,526	300,572	—	61,150
July ...	136,463	51,020	41,290	286,646	—	—
August ...	67,292	116	60,581	130,774	—	2,544
September	172,192	386	65,349	302,802	—	—
	<b>2,325,885</b>	<b>833,091</b>	<b>460,866</b>	<b>1,576,189</b>	<b>400</b>	<b>64,791</b>

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**COMPANY MATTERS**
**W. H. Dorman and Co., Ltd.**

THE annual report of the directors for the year ending July 31 shows that the nett profits for the year, after providing for all working expenses, Excess Profits Duty, and Corporation Profits Tax, are £72,980. To this figure must be added the amount brought forward from the previous year less the amount of Excess Profits Duty payable to July 31, 1919, bringing the total up to £100,356. The fixed dividend on the 8 per cent. cumulative participating preference shares to June 1, 1920, amounting to £5,363, has been paid, leaving available for disposal £94,992. The whole of the expenses incurred in the capital issue of December last, amounting to £17,874, has been written off. The directors recommend the payment of the dividend on the cumulative participating preference shares at the rate of 8 per cent. per annum up to and including July 31 last, with an additional 1 per cent. dividend thereon in respect to the year; also a dividend on the ordinary shares at the rate of 12 per cent. per annum. These dividends to be paid on December 1 next, together with a further four months' dividend which will then be due on the cumulative participating preference shares at the rate of 8 per cent. per annum, in order that the dividends on the Ordinary shares may coincide in future with the dates on which the preference dividends are paid.

**Sopwith Aviation and Engineering Co., Ltd.**

A MEETING of the creditors of the company was held on October 6, at the Institute of Chartered Accountants, Moorgate Street, E.C. The chair was occupied by Mr. R. M. Peat, who with Mr. H. P. Musgrave had been appointed to act as the liquidators in the voluntary liquidation of the company.

It was stated by the Chairman that the company was formed as a private limited liability concern in 1913, with a nominal capital of £26,000. At the outbreak of the War the company employed about 200 persons. At the Armistice 6,000 people were employed. After the Armistice the company undertook the production of motor-cycles, for which the works were reorganised and machinery valued at £100,000 was introduced.

Unfortunately, when the economical production of the bicycle was achieved, the seasonal slump, which this year was earlier than usual, set in. Up to a year ago the company did very well and had accumulated reserves of more than £900,000. An approximate statement showing the position disclosed total liabilities of £705,430, while the assets were £862,630. The liabilities included £583,510 for excess profits duty, but that figure would be subject to considerable modification when the company's trading had been ascertained, and a sum of £136,000 was disputed by the company. The company had previously paid £450,000 in excess profits duty. He added that the best results in the liquidation would be achieved by the sale of the business as a going concern, and the liquidators would encourage any enquiries. Several enquiries had already been received, but no definite offer had been made.

In the discussion the opinion was expressed that the unsecured creditors should be represented in the liquidation of the company, and eventually a resolution was passed that an application should be made to the Court for the appointment of Mr. W. H. Chantrey to act as joint liquidator with the Chairman in the voluntary liquidation of the company.

**PUBLICATIONS RECEIVED**

*In the Blue.* By Major S. H. Long, D.S.O., M.C. London: John Lane. Price 5s. net.

*Model Aeroplane: Its Practice and Principles.* By V. E. Johnson, M.A. London: E. and F. N. Spon. Price 12s. 6d. net. By post 13s. Abroad 13s. 6d.

*The Output Problem.* By J. E. Powell. The Manufacturing Problem Series. London: The Library Press, Ltd. Price 6s. net.

*Patents for Inventions.* King's Patent Agency, Ltd., 146A, Queen Victoria Street, London, E.C. 4.

*Annual Report of the Smithsonian Institution, 1917.* The Smithsonian Institution, Washington, D.C., U.S.A.

*Scientific Papers of the Bureau of Standards.* No. 353. *Variation in Direction of Propagation of Long Electro-magnetic Waves.* By Lieut.-Com. A. Hoyt Taylor, U.S. N.R.F. Government Printing Office, Washington, D.C., U.S.A. Price 5 cents.

*Dorman Wave Power Transmission Tools.* W. H. Dorman and Co., Ltd., Stafford.

*Report No. 84. Data on the Design of Plywood for Aircraft.* National Advisory Committee for Aeronautics, Navy Buildings, Washington, D.C., U.S.A.

*Technical Note No. 12. Recent Efforts and Experiments in the Construction of Aviation Engines.* By Schwager. The National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

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**AERONAUTICAL PATENT SPECIFICATIONS**

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motors  
The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

**APPLIED FOR IN 1919**

Published October 14, 1920

10,627.	MACKENZIE, HOLLAND AND WESTINGHOUSE POWER SIGNAL CO., and L. H. PETER. Control of aerial traffic. (151,041.)
14,868.	H. NEWMAN. Aeroplane control. (151,068.)
14,935.	G. W. CRANFIELD. Balloon rigging. (151,077.)
15,030.	F. M. GREEN, G. LLOYD AND ARMSTRONG-SIDDELEY MOTORS, LTD. Metal aeroplane framework fittings. (151,085.)
16,478.	L. A. McDougall and J. M. POYNTZ. Wireless apparatus for aircraft. (151,115.)
17,295.	A. L. WHITTELL. Rotary engines. (151,124.)
18,328.	ARMSTRONG-SIDDELEY MOTORS, LTD., and W. S. FARREN. Hinges for control surfaces of aircraft. (151,133.)
21,668.	L. E. EEMAN. Seaplanes, etc. (151,153.)
22,033.	J. G. GRAY. Gyroscopic apparatus. (151,154.)
23,309.	ETAB. BALLOT. Reciprocating engines. (151,155.)
28,647.	R. P. PESCARA. Transmission of power to propellers of helicopters. (151,181.)

If you require anything pertaining to aviation, study "FLIGHT'S" Buyers' Guide and Trade Directory, which appears in our advertisement pages each week (see pages xix and xx).

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